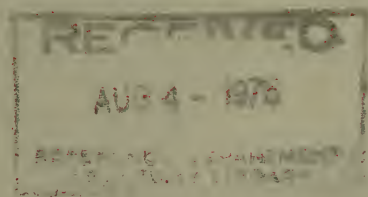


# harvard school of public health 1976/1977



**OFFICIAL REGISTER OF  
HARVARD UNIVERSITY**  
VOLUME 73, NUMBER 2 / JULY 5, 1976





# HARVARD SCHOOL OF PUBLIC HEALTH

Announcement of Courses  
and General Information

1976-77

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677 Huntington Avenue, Boston, Massachusetts 02115

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## **OFFICIAL REGISTER OF HARVARD UNIVERSITY**

These publications include the report of the president; the general catalog issue; the announcements of the College and the several professional schools of the University; the courses of instruction; the pamphlets of the several departments; and the like.

Every effort is made to insure that the information contained in this catalog is accurate at the time of publication. However, the School of Public Health reserves the right to make changes without notice in tuition and fees, admission and degree requirements, courses of instruction, and any other information contained herein.

Credit for photograph on title page: Balthazar Korab.

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## ACADEMIC CALENDAR, 1976-77

- \*September 20, Monday      Opening orientation session and preliminary  
10 a.m.      registration for new international students
- \*September 21, Tuesday      Opening orientation session and preliminary  
2 p.m.      registration for new U.S. students

The period between the opening sessions and September 27 will be devoted to orientation lectures, individual conferences with faculty members, and selection of courses of study.

- \*September 23, Thursday      Opening session and registration for students  
10 a.m.      enrolled in 1975-76

### Fall Term, September 27, 1976, through January 28, 1977

- September 27, Monday      First period courses begin
- October 11, Monday      Columbus Day: a holiday
- November 11, Thursday      Veterans' Day: a holiday
- November 20, Saturday      First period ends
- November 22, Monday      Second period courses begin
- November 25 and 26      Thanksgiving recess  
Thursday and Friday

*Recess from Sunday, December 19, 1976, through Sunday,  
January 2, 1977*

- January 10, Monday      Spring term registration period  
through  
January 14, Friday
- January 29, Saturday      Second period courses end
- January 31, Monday      Supervised special studies or field  
through      observations  
February 5, Saturday

### Spring Term, February 7, 1977, through June 16, 1977

- February 7, Monday      Third period courses begin
- February 21, Monday      Washington's Birthday: a holiday
- April 2, Saturday      Third period ends

\*All students are required to attend the opening session and to be present for the registration period.

*Recess from Sunday, April 3, 1977, through Sunday,  
April 10, 1977*

April 11, Monday	Fourth period courses begin
May 30, Monday	Memorial Day: a holiday
June 4, Saturday	Fourth period ends
June 6, Monday through June 15, Wednesday	Post-class period
June 16, Thursday	Commencement



## ADMINISTRATION OF THE UNIVERSITY

### President and Fellows of Harvard College

(This Board is commonly known as the Corporation.)

Derek Curtis Bok, A.B., J.D., A.M., LL.D., *President*  
Francis Hardon Burr, A.B., LL.B., *Senior Fellow of Harvard College*  
Hugh Calkins, A.B., LL.B., *Fellow of Harvard College*  
John Morton Blum, A.B., A.M., Ph.D., *Fellow of Harvard College*  
Charles Pence Slichter, A.B., A.M., Ph.D., *Fellow of Harvard College*  
Robert Gregg Stone, Jr., A.B., *Fellow of Harvard College*  
George Putnam, A.B., M.B.A., *Treasurer of Harvard College*  
Robert Shenton, A.B., M.B.A., Ph.D., *Secretary to the Corporation*  
Frances Mary Gabron, *Assistant Secretary to the Corporation*

## ADMINISTRATION OF THE SCHOOL OF PUBLIC HEALTH

### Administrative Officers

Derek Curtis Bok, A.B., J.D., A.M., LL.D., *President*  
Howard Haym Hiatt, M.D., *Dean of the Faculty of Public Health*  
James Laverre Whittenberger, S.B., M.D., A.M. (hon.), *Associate Dean of the Faculty of Public Health and Director of the Kresge Center for Environmental Health*  
Joseph David Brain, A.B., S.M., S.M. in Hyg., S.D. in Hyg., *Acting Associate Dean for Academic Affairs*  
Richard Clark Killin, A.B., LL.B., *Associate Dean for Administration*  
Thomas Huckle Weller, A.B., S.M., M.D., LL.D., *Director of the Center for the Prevention of Infectious Diseases*  
William Alonso, A.B., M.C.P., Ph.D., *Director of the Center for Population Studies*  
Jeannette Jane Simmons, S.B., M.P.H., S.D. in Hyg., *Assistant Dean of Students*  
Roger Benham Spaulding, A.B., *Assistant Dean and Director of the Development Office*  
Howard Jules Levy, S.B., S.M., M.B.A., *Assistant Dean for Financial Affairs*  
Gordon Chase, A.B., *Director of the Office of Executive Programs in Health Policy and Management*  
Stephen Carl Joseph, A.B., M.D., M.P.H., *Director of the Office of International Health Programs*  
H. Richard Nesson, A.B., M.D., *Director of the Office of Extramural Health Programs*  
Howard Stanley Frazier, Ph.B., M.D., *Director of the Center for Analysis of Health Practices*

Herbert Sherman, B.E.E., M.E.E., D.E.E., *Director of the Office of Program Planning*  
 Thora Haysey Stukas, A.B., *Director of Admissions and Registrar*  
 Margaret Dale Penrose, A.B., A.M., *Assistant to the Dean and Director of Shattuck International House and Alumni Affairs*  
 Emily Kramer Morrison, S.B., *Assistant to the Dean*  
 Margaret Catherine Salmon, S.B., *Assistant to the Dean for Faculty Administration and Financial Aid Officer*  
 Jay Andrew Winsten, A.B., Ph.D., *Assistant to the Dean*  
 Raymond Kenneth Neff, A.B., S.M. in Hyg., *Director of the Health Sciences Computing Facility*  
 James Joseph Feeney, A.B., M.D., *Director of the Medical Area Health Service*

### **Administrative Board**

Derek C. Bok, *President (ex officio)*

Howard H. Hiatt, *Chairman*

William Alonso

Howard S. Frazier

Robert P. Geyer

Robert J. Haggerty

Brian MacMahon

George S. Masnick

Dade W. Moeller

Roger L. Nichols

Julius B. Richmond

Thomas H. Weller

James L. Whittenberger

Jane Worcester

Margaret C. Salmon, *Secretary*

# The Harvard School of Public Health

The Harvard School of Public Health is primarily devoted to graduate education for those who seek careers in service, teaching, and research in public health.

Public health evolved from the early combination of medical science and engineering for the control of environmental hazards. It has grown to embrace various facets of the natural, mathematical, and social sciences as community aspects of health problems have become more complex and demanding. Public health now depends upon the skills and knowledge of members of several professions. The role of a graduate school of public health today is to prepare those who will be concerned with health problems which exceed the scope of any single discipline, many of which can be solved best through the skillful cooperation of specialists from the fields of medicine, statistics, epidemiology, engineering, management, public policy, law, economics, sociology, chemistry, biology, and many others.

## HISTORY OF THE SCHOOL

Activity in professional education in the field of public health had been steadily increasing in Harvard University for more than two decades before the actual founding of the School in 1922. Its gradual development was characterized by certain important steps, the first of which was the establishment, in 1909, of the Department of Preventive Medicine and Hygiene in the Medical School — the first such department in the United States. The degree of Doctor of Public Health was first conferred in 1911. In that year a Department of Sanitary Engineering was established in the Graduate School of Engineering. In 1913, the Department of Tropical Medicine and, in 1918, the Division of Industrial Hygiene, with clinical and laboratory facilities, were organized in the Harvard Medical School.

In 1913, the Harvard–Massachusetts Institute of Technology School for Health Officers was formed under the joint management of Harvard University and the Massachusetts Institute of Technology. This School operated until the fall of 1922, when it was superseded by the Harvard School of Public Health, made possible by an endowment for this purpose from the Rockefeller Foundation.

In the early years of the School's operation, several of its depart-

## **SCHOOL OF PUBLIC HEALTH**

ments functioned as joint departments with the Medical School, with shared facilities, faculty, and budgets. In 1946, the School was separated administratively and financially from the Medical School and became an autonomous unit of Harvard University. It continues to cooperate with the Medical School in teaching and research, and has also developed close associations with other divisions of the University, particularly the Graduate School of Arts and Sciences, the John F. Kennedy School of Government, and the Graduate School of Business Administration.

### **OBJECTIVES OF THE SCHOOL**

The objectives of the School of Public Health are the advancement of knowledge and graduate education in the relevant disciplines and problem areas of public health.

In its efforts to advance knowledge, the School is concerned with health problems of major importance to society, not only in the highly urbanized and technologically advanced regions, but also in the predominantly rural or economically disadvantaged areas of the world.

The educational program of the School offers instruction in the community-oriented health sciences and in the techniques of administration for able men and women who have potential for imaginative leadership. In addition to the education of physicians and other professionals, high priority is given to the postbaccalaureate preparation of young people for careers in the health system, and to the provision of opportunities for graduate students in law, business, government, education, and other fields to prepare for application of their special skills to health problems.

In its involvement in the contemporary health problems of society, the School collaborates with community leaders in seeking ways in which knowledge can be effectively used for the advancement of human health. The School is forging more and stronger links with community health agencies to provide settings for training and research analogous to those available to medical students and faculty in teaching hospitals.

The School has the dual role of providing both professional and graduate education, offering the degrees of Master and Doctor of Public Health, Master and Doctor of Science, and Master of Industrial Health.

## LOCATION AND RESOURCES

The main buildings of the School of Public Health are the Health Sciences Laboratories at 665 Huntington Avenue, and the Sebastian S. Kresge Educational Facilities Building at 677 Huntington Avenue, Boston. These buildings are near the Harvard Medical and Dental Schools; the Countway Library of Medicine; the Children's Hospital Medical Center; the Beth Israel, Peter Bent Brigham, and Women's Hospitals; and other Harvard-affiliated hospitals.

### Health Sciences Computing Facility

Computing and data processing services are available to students through the Health Sciences Computing Facility (HSCF), which is operated by the School of Public Health. A staff of systems analysts and computer programmers assists researchers and students from all of the Harvard Medical Area institutions in using the computer as a tool for analyzing data, for doing extensive numerical calculations, and for acquiring, maintaining, and processing large data bases.

HSCF is equipped with unit record machines, including a counting card sorter and a variety of card punching machines. Remote batch processing computing is accomplished by a high-speed telephone link to the IBM 370/168 computer at the Massachusetts Institute of Technology. Interactive computing (time sharing) capability is provided by low-speed terminals which are connected to several large computers in the New England area, notably the IBM 370/168 at the Massachusetts Institute of Technology and the Honeywell 66/40 at Dartmouth College.

HSCF staff members give a course in computing (Biostatistics 213b). There are also special tutorials for interested students who have had prior computing experience. The Director of the HSCF is Mr. Raymond K. Neff.

### Libraries

The library needs of the School of Public Health are served principally by the Francis A. Countway Library of Medicine, located at 10 Shattuck Street. The Countway Library combines the resources and services of the Harvard Medical Library and the Boston Medical Library. Among libraries serving medical and health-related schools, it is the largest in the country, with recorded holdings of more than 460,000 volumes and 4,600 periodicals. The Countway Library also

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has extensive collections of historical materials, dating from the fifteenth century. Its history of medicine department provides modern facilities for the use of these books and other rarities.

All members of the University may borrow from the Harvard College library at Cambridge. Messenger service is provided daily between the college library, various other Harvard University libraries, and the Countway Library. The Boston Public Library, libraries of the Massachusetts Institute of Technology, and other libraries of the Boston area add to the total book and periodical resources available to students.

### **Other Resources**

Students at the School may enroll in courses in other divisions of Harvard University, e.g., in the natural sciences, public administration, economics and other social sciences, statistics, and medical sciences. Certain graduate courses at the Massachusetts Institute of Technology are also open to students at the School. Students will generally be granted credit for such courses toward degrees being earned at the School of Public Health, with the exception of courses in foreign languages. Credit granted for cross-registered courses may not exceed one-half of the credit units required for the degree in question.

The School maintains a close association with a wide variety of health, medical care, and welfare organizations in Massachusetts and elsewhere. The facilities of hospitals and certain other institutions adjacent to the School are available to qualified students. Other local, national, and international health facilities provide opportunities for observation and special studies, and members of their staffs are available to assist in the School's educational program. The State Laboratory Institute of the Massachusetts Department of Public Health offers excellent opportunities for qualified students to obtain experience in laboratory methods pertinent to public health.

## **CENTERS AND OFFICES**

### **Center for Analysis of Health Practices**

The Harvard School of Public Health has established a Center for Analysis of Health Practices in response to the increasingly recognized need for better analysis of diagnostic and therapeutic measures in current use or under development in the health fields.



The Center brings together professionals from various disciplines, including clinical medicine, statistics, law, ethics, epidemiology, and public policy, to cooperate in such activities as:

1. Survey and identification of clinical problems where current diagnostic or therapeutic modalities are of uncertain validity or merit;
2. Investigation of the effectiveness of health practices, including inquiry into the cost-benefit, public policy, ethical, and legal aspects of procedures that are in use or proposed for adoption;
3. Participation in the design and analysis of clinical trials, to be undertaken in teaching hospitals and elsewhere;
4. Training clinical investigators, statisticians, and others in the principles of clinical research.

The Director of the Center is Howard S. Frazier, M.D. The Clinical Director is Peter Braun, M.D.

### **Center for Community Health and Medical Care**

The Center for Community Health and Medical Care was established under the joint auspices of the Harvard Medical School and the Harvard School of Public Health to serve as a focus for research and development in the organization, delivery, financing, and evaluation of health care.

The interdisciplinary staff and faculty members of the Center are concerned with the design of experimental programs as well as the study of existing arrangements, mechanisms, institutions, and related personnel involved in providing personal health services. Special emphasis is placed on evaluation and the refinement of evaluation methodology applicable to this field.

The program of the Center includes:

1. Research in the organization and delivery of health services;
2. Postdoctoral fellowship programs designed to prepare professionals with the capability to design, plan, manage, and evaluate the instrumentalities and the systems for the delivery of health services.

Through its involvement of several faculties of the University and through its programs for young physicians and other professionals, the Center provides a focus for the health activities of Harvard which

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are broadly directed toward the improvement of health services and medical care.

The Director of the Center is Paul M. Densen, S.D.

### **Center for Educational Development in Health**

The role of community-oriented instruction in medical education has been receiving increasing recognition in recent years. Major changes are taking place in the teaching of public health and preventive medicine, both in the United States and abroad. The challenge of expanding teaching responsibilities has led to a growing need for qualified teachers of public health, preventive medicine, and preventive dentistry in schools of public health, medicine, and dentistry as well as in community-based health programs.

The interest of the Harvard School of Public Health in preparing students for teaching posts both within the United States and abroad is underscored by the fact that approximately 60 percent of the students plan to teach on a full-time basis following graduation from the School. The School has responded to the needs of these students by developing a number of special courses in teaching methods to supplement the various programs of the departments of the School. The major goals of these courses are:

1. To develop competence in the formulation of educational policy in the field of community medicine and public health;
2. To introduce students to modern educational methods and media and enable them to utilize specific methods to implement their own instructional objectives;
3. To help students to develop patterns of self-education through which they may continue to increase their competence in teaching after completion of the program.

These courses may be taken as part of a program leading to either a Master of Public Health or Master of Science degree.

The objectives of these courses are carried out by means of special seminars, workshops, and tutorial instruction. Participants include faculty from other divisions of Harvard University as well as specialists in medical education from departments of community medical education in this country and abroad. The basic course provides an overview of principles of curriculum design, formulation of educational objectives, selection of teaching methods, and evaluation. In addition, seminars are offered on special problems and issues associated with teaching community medicine and public health. The various



approaches to teaching are considered in historical and geographical perspective and in relation to the changing goals of education in the health sciences.

Further information on these special courses may be obtained by addressing inquiries to Dr. Ascher J. Segall, Associate Professor of Epidemiology, Harvard School of Public Health.

### **Center for Population Studies**

The Center for Population Studies was established in 1964 under the leadership of the School of Public Health, as a University-wide Center to join scholars and scientists in different fields in a common approach to human population problems. A faculty advisory committee, representing all the faculties of Harvard University, guides the operation and development of the Center. The members and research associates of the Center are drawn from the Departments of Biology, Economics, Government, and Sociology; the Division of Engineering and Applied Physics; and the Schools of Public Health, Design, Education, Medicine, and Divinity. The Center maintains two offices, one in Boston in the School of Public Health, and one in Cambridge.

In the School of Public Health, the Department of Population Sciences welcomes qualified candidates for the various degrees offered by the School. Elsewhere in the University, courses and seminars open to all qualified students are given by members of the Center in the Departments of Biology, Economics, Sociology, Government, and General Education and in the Medical School, the Graduate School of Design, the Divinity School, and the Graduate School of Education.

The present research programs of the Center and the Department focus on several themes: laboratory and clinical research programs in human reproductive biology, aimed at developing new methods of human fertility control; economic, social, and environmental determinants and consequences of population change in the less developed countries, including public health aspects of fertility control and the balance between populations and their resources; problems of urbanization and internal migration in both developed and less developed countries; theories of population kinematics and dynamics and their implications for public policy; political and ethical aspects of population policy; historical population studies; population education; and adolescent growth and menarche.

The Director of the Center is William Alonso, M.C.P., Ph.D. Elihu Bergman, Ph.D., is Assistant Director and Member of the Center.

### **Center for the Prevention of Infectious Diseases**

The Center for the Prevention of Infectious Diseases comprises the Departments of Microbiology and Tropical Public Health. Working in close collaboration, the staffs of the two Departments are concerned with the broad spectrum of agents, i.e., viral, rickettsial, chlamydial, bacterial, mycotic, protozoal, and helminthic entities, that parasitize man and with their relevant arthropod and molluscan vectors.

On a global basis the infectious diseases remain a primary cause of mortality. In the developed areas of the world, morbidity attributable to infectious diseases persists as a major impediment to the enjoyment of complete health. An increasing number of chronic degenerative diseases are recognized as stemming from the insults of prior infectious processes. In many societies, acceptance of the concept of population control awaits containment of undue mortality induced by the infectious diseases and the consequent assurance that children who are born will have a reasonable prospect of achieving maturity. Considerations such as the foregoing emphasize the continuing need for the public health expert to possess knowledge of the rapidly changing technology of the control of infectious diseases, as well as basic knowledge concerning the attributes and epidemiologic characteristics of the responsible agents.

The faculty of the Center for the Prevention of Infectious Diseases operate in close collaboration to discharge a common responsibility for multidisciplinary instruction in the various facets of diseases of infectious etiology. The formal course offerings of the two Departments are designed and scheduled to permit the acquisition of a broad basic knowledge of infectious diseases as well as an introduction to specialized subject areas. For qualified advanced students, concentration in specific areas with participation in collaborative or individual research is encouraged at both predoctoral and postdoctoral levels. The wide variety of current research projects in the Center permits acquisition of experience both at home and abroad, in the laboratory or in the field. Training grant funds may be available for the support of qualified individuals specifically interested in the study of bacteriology, virology, mycology, parasitology, venereal disease, rickettsiae, chlamydiae, and tropical medicine in relation to public health.

The Director of the Center is Thomas H. Weller, M.D.; the Associate Director is Roger L. Nichols, M.D.

**The Kresge Center for Environmental Health**

This Center includes the Departments of Physiology, Sanitary Engineering, and Environmental Health Sciences. The Center serves as a focus for environmental health activities within the School of Public Health. It also represents Harvard University in the New England Consortium on Environmental Protection and conducts environmental health teaching activities elsewhere in Harvard University. Such projects include undergraduate courses in environmental health for students in Harvard and Radcliffe Colleges, and joint seminars with the Division of Engineering and Applied Physics of the Graduate School of Arts and Sciences.

Full-time faculty within the Center include physicians, engineers, physiologists, mathematicians, toxicologists, chemists, physicists, meteorologists, and other professionals. This diversity enables the staff to deal effectively with environmental problems which require a multidisciplinary approach.

Specific subject categories in which the Center conducts research and training include:

1. Air pollution effects and control
2. Environmental toxicology
3. Radiation biology
4. Medical radiological physics
5. Industrial hygiene
6. Occupational medicine
7. Radiological health (health physics)
8. Respiratory physiology
9. Sanitary engineering
10. Environmental health management

Degree programs available within the above areas include the Master of Science, Master of Industrial Health, Doctor of Science, and Doctor of Public Health. Formal requirements for each of these degrees are outlined in other sections of the catalog. Students interested in any of the above areas ordinarily enroll in the School of Public Health. Students whose primary interest is in problems of water quality and water resources generally enroll in the Division of Engineering and Applied Physics of the Graduate School of Arts and Sciences.

The Director of the Kresge Center is James L. Whittenberger, M.D. The Associate Director is Dade W. Moeller, Ph.D. Applicants desiring

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further details concerning any of the programs of the Center are encouraged to write to the Director of Admissions, to the head of the appropriate department, or to the Director of the Center.

### **Office of Extramural Health Programs**

The Office of Extramural Health Programs at the School of Public Health is developing working relationships with components of the health system, including governmental agencies, providers of health services, and organizations of consumers. A principal objective is to provide training positions for students and research opportunities for faculty in operating health agencies and organizations outside the academic setting. The Office is responding to requests from communities for advice and assistance on problems that may be addressed by faculty and students, not only from the School of Public Health, but also, as appropriate, from other parts of the University.

Active working relationships with a wide spectrum of providers, payors, and regulators have developed into a unique blend of technical assistance, education, and research. The Office is currently involved in a major joint effort with the Peter Bent Brigham Hospital and the Affiliated Hospital Center to develop a service and training program in primary medical care and health services administration.

The Director of the Office is H. Richard Nesson, M.D.

### **Office of International Health Programs**

The School of Public Health provides opportunities for preparation for careers in teaching, research, and service in international health. Various programs available within the School, together with related course offerings in other divisions of Harvard University and the Massachusetts Institute of Technology, offer the student a broad background for future careers with international agencies, mission groups, philanthropic foundations, and foreign governmental and academic institutions. Cross-registration opportunities are available for students interested in medicine, economics, public administration, education, anthropology, government, social relations, and related subjects appropriate to particular regions of the world. (Students may also cross-register for courses in foreign languages, but may not receive credit for such courses toward degrees being earned at the School of Public Health.)

The poor health conditions characteristic of less developed areas are the primary focus for many of the teaching and research activities

of the School. In conjunction with the Harvard Institute for International Development, the School is working toward a more comprehensive and coherent program for those whose primary responsibilities will be concerned with the health problems of developing countries, especially as these health problems interact with the problems of nutrition and rapid population growth and the larger questions of health and social and economic development.

Courses may be selected as part of programs leading to the Master of Public Health or Master of Science degrees. Physicians preparing for certification by the American Board of Preventive Medicine may receive approval for a residency program in General Preventive Medicine (International Health). Areas in which supervised field work or research may be undertaken will vary, depending on current opportunities afforded, the availability of qualified supervision, and provisions for financing.

Further information may be obtained from Dr. Stephen C. Joseph, Director, Office of International Health Programs, Harvard School of Public Health.

## **CONTINUING EDUCATION**

The School of Public Health offers a variety of continuing education programs and short courses for existing health professionals. Most of these programs are offered through Executive Programs in Health Policy and Management (described below); short courses in various aspects of environmental health and other areas are also available.

### **Executive Programs in Health Policy and Management**

Harvard University established Executive Programs in Health Policy and Management in July, 1974. Under a five-year contract with the U.S. Department of Health, Education, and Welfare, it will develop and present a series of continuing education programs in health management, policy, planning, and regulation for executives involved in health care.

The program is based at the School of Public Health, and draws on other University resources, including the Graduate School of Arts and Sciences, the Harvard Business School, and the John F. Kennedy School of Government.

Most offerings will be given for professionals in senior levels of responsibility in their organizations. Some programs are planned for



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those at middle-management levels. Organizational sponsorship is usually required.

Courses are offered in three major areas:

1. Management of health care systems and institutions
2. Health policy, planning, and regulation
3. Management and regulation of environmental health services

The program does not offer courses in the clinical aspects of medicine and public health.

Information on specific course offerings may be obtained from Gordon Chase, Director, Executive Programs in Health Policy and Management, 677 Huntington Avenue, Boston, Massachusetts 02115.

# Admission and General Information for Students

## APPLICATION FOR ADMISSION

Applicants must submit the following for consideration by the Committee on Admissions and Degrees: (1) completed application form; (2) transcripts of academic record at college, graduate school, and/or professional school; (3) names of at least three people, well acquainted with the applicant's previous work, from whom letters of recommendation have been requested. In addition, the Graduate Record Examination is required of certain applicants, as noted elsewhere in this catalog.

An application fee of \$15, which is not refundable, is required for each formal application. A check drawn on a bank in the United States, a postal money order, or an international money order, payable to the Harvard School of Public Health, must accompany the application.

In addition to fulfilling the specific requirements for admission to a degree program, applicants must satisfy the Committee on Admissions and Degrees as to their ability to undertake advanced study at a graduate level. The final decision as to the admissibility of an applicant rests with the Committee.

The School is unable to accept all who are eligible for admission. Therefore, persons who wish to be considered for admission must submit their applications by *February first* prior to the academic year in which they wish to enroll. Spring term applications are not encouraged, because of the sequence of course offerings at the School. Candidates seeking admission in the spring term should first contact the department or program of interest to determine whether application for admission at that time is permissible.

Admission of a candidate is for a particular year; if enrollment at that time is not possible, reapplication is necessary and will be considered on the same competitive basis as a new application.

As a matter of policy, Harvard University does not discriminate among applicants and students in admissions, educational policies, scholarship and loan programs, and athletic and other programs on the basis of race, religion, sex, national origin, or color. The School of

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Public Health encourages women and members of minority groups to apply for admission.

### **International Students**

*Language Proficiency.* Applicants from countries in which the language of instruction is not English must satisfy the Committee on Admissions and Degrees as to their ability to speak, read, write, and understand the English language competently. The applicant should have sufficient knowledge of English to enable him to understand lectures in English, to participate in seminar discussions, and to write examinations. In the absence of sufficient evidence from the sponsoring agency and other sources, the School will request that the applicant take and pass satisfactorily the Test of English as a Foreign Language. The test is administered four times a year at centers throughout the world. Applicants are advised to take this test as early as possible in the admissions process. Information concerning the test may be obtained by writing to the Test of English as a Foreign Language, Box 899, Princeton, New Jersey 08540. Certification of English proficiency must be received by the School before the immigration form needed to obtain a visa to enter the United States can be issued to the student.

*Financial Certification.* The School has adopted the following policy regarding foreign nationals who are applying for admission from outside the United States. An applicant whose financial support is not guaranteed by an official U.S. agency or foundation must submit evidence satisfactory to the School that he will have sufficient funds available in U.S. currency to enable him to pay his expenses for the full period of his academic program, and that he is permitted to exchange or export these funds. Certification of adequate financial resources must be received by the School before the immigration form needed to obtain a visa to enter the United States can be issued. Foreign students who are wholly supported by personal funds will be required to have adequate funds on deposit in a U.S. bank before the immigration form will be issued.

Foreign nationals admitted to the School and already residing within the United States will also be required to submit satisfactory evidence of sufficient funds to cover their expenses for the full period of their academic program. Such students will not be permitted to register at the School unless certification of adequate financial resources has been received.



## **GENERAL INFORMATION**

An estimate of living expenses in the Boston area may be found in the section entitled "Living Expenses" on page 26.

All inquiries and communications regarding admission should be addressed to the Director of Admissions, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

## **PART-TIME STUDENTS**

(Degree Candidates)

Students may register as part-time degree candidates with the approval of the Committee on Admissions and Degrees. Ordinarily this requires half-time attendance. A one-year program may be completed in two academic years, a two-year program in three academic years. Ten credit units per term constitute a regular program for half-time students. Half-time students may register for no more than 12.5 credit units per term.

## **SPECIAL STUDENTS**

Subject to availability of space, the School may accept a few students, on a full-time or part-time basis, who are not degree candidates, but who are interested in taking one or more courses in a special field. Candidates should specify on the application form the courses they plan to take. Procedures and requirements for the admission of such students are the same as for degree candidates. Special students who later wish to be admitted to degree candidacy will be considered on the same basis as other applicants for admission. Admission as a special student carries with it no commitment to accept the applicant as a degree candidate.

## **CREDIT ASSIGNMENT**

Credit units are assigned on the basis of the total amount of time required by a course, both in class and outside of class. Twenty credit units constitute a full program for one term. A full-time student may register for no more than 25 credit units per semester unless permission is obtained from the Committee on Admissions and Degrees.

## TUITION AND FEES

The tuition fees for the academic year 1976-77 are listed below. These include the Health Service fee for medical care for all resident students enrolled for 6 or more credit units. (Hospital insurance, which is billed separately, is discussed later in this section.)

	1976-77
Full-time resident students .....	\$4,000
Half-time resident students .....	2,250
All resident students pay tuition at the above rates with the following exceptions:	
Doctoral candidates or special students in the second or later years of a doctoral or special program:	
Full-time resident students .....	2,250
Half-time resident students .....	1,300
Nonresident doctoral candidates, registered <i>in absentia</i> .....	200
Part-time special students, enrolled for 6 or more credit units:	
First credit unit of work per term .....	245
Each additional unit per term up to 10 units .....	100
Part-time special students, enrolled for 5 or fewer credit units:	
First credit unit of work per term .....	170
Each additional unit per term up to 5 units .....	100
Summer session — effective July 1, 1977	
Students who register and receive credit for research or supervised study during 12-week summer period .....	550
Students registered for less than 12 weeks will pay at a proportionate rate.	

*Hospital Insurance.* A Blue Cross/Blue Shield student insurance plan provides coverage for many costs of medical care not offered at the University Health Services. All students are enrolled in this plan unless they have other adequate medical insurance and submit a waiver within two weeks following registration. Waivers are approved by the Director of the University Health Services. Coverage under the student insurance plan extends from September 1 through August 31. The premium for 1976-77 is \$78.

### Payment of Fees

Bills for tuition and fees will be issued and payable as follows:

*Student term bill worksheets for the fall term* will be issued on August 1, and will be payable *in full* by August 20.

*Bills for the spring term* will be issued on January 1, and will be payable *in full* by January 15.

Payments may be scheduled over monthly installments (four each term) through an optional payment plan that is available at a service charge of \$15 per term.

A student who leaves the School during the academic year is responsible for tuition charges in accordance with the following:

<i>Leaves by</i>		<i>Percent of Total</i>
<i>First Term</i>	<i>Second Term</i>	<i>Semester Charges</i>
October 25	February 25	25%
November 25	March 25	50%
December 24	April 25	75%

Students leaving after December 24 and April 25 of the first and second terms, respectively, are responsible for full tuition charges.

Students who are candidates for degrees must have paid all dues to the University at least one day before the day upon which the degrees are to be voted.

A student who leaves the University for any reason whatever must pay all charges against him immediately upon receipt of a bill from the Office of Fiscal Services. Every student is held responsible for the payment of fees until he has notified the Dean of his intention to withdraw from the School.

All term bills are sent to the student at his local address unless the Office of Fiscal Services is requested in writing to send them elsewhere.

Any student whose indebtedness to the University remains unpaid on the date fixed for payment is deprived of the privileges of the University. Reinstatement is obtained only by consent of the Dean of the School in which the student is enrolled after payment of all indebtedness and a reinstatement fee of \$10. As a further condition of reinstatement, the student is required to file with the Office of Fiscal Services a bond in the amount of \$1000 as security for the payment of future term bills.

## SCHOOL OF PUBLIC HEALTH

### Field Studies

Field opportunities, listed under each department's course offerings and bearing the course number 330, often entail travel expenses that must be met by the student. Information about estimated expenses should be obtained from the appropriate department.

## LIVING EXPENSES

Living costs in the Boston area are higher than in most areas from which students come. The following are *minimum* amounts estimated that students will need in order to cover expenses for approximately nine months.

A single person will need at least \$8,800, in addition to travel expenses, to cover the cost of tuition and health insurance (\$4,078), rent (\$2,400), and other living expenses (\$2,322).

A family of four will need at least \$15,130, in addition to travel expenses, to cover the cost of tuition and health insurance (\$4,078), rent (\$3,250), and other living expenses (\$7,802), including medical care.

## FELLOWSHIP AND LOAN PROGRAM

The Harvard School of Public Health is a participant in the Harvard University Federally Insured Student Loan Program. This program permits a student who either is a U.S. citizen or has immigrant status to borrow up to \$2,500 a year, providing the student has less than \$10,000 in outstanding loans.

Some fellowship support is awarded through departments and special programs from federal and nonfederal sources.

Detailed information about the fellowship and loan programs can be obtained by writing to Ms. Margaret C. Salmon, Financial Aid Officer, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

## HOUSING

The Henry Lee Shattuck International House is an apartment residence operated on a nonprofit basis by the Harvard School of Public Health for its full-time students and their families from the United States and abroad. Located at 199, 203, and 207 Park Drive, within

## GENERAL INFORMATION

walking distance from the School, the House consists of sixty-four individual apartments, each with its own kitchenette and bath.

All apartments are rented furnished with basic items except for linens, blankets, and kitchen utensils, and are leased for the ten-month period from September 1 through June 30. No unfurnished units are provided. Special arrangements can be made for July and August. The monthly rent charge includes all utilities — hot water, heat, gas, and electricity — but not telephone service.

For application forms and more detailed information write:

Mrs. Margaret D. Penrose  
Director, Shattuck International House  
Harvard School of Public Health  
677 Huntington Avenue  
Boston, Massachusetts 02115

May 15 is the deadline for submitting applications. However, late applications will be considered as long as space is available.

The Shattuck International House is the only student housing provided through the School. Students who are not interested in residing at the House must find their own housing independently. The School of Public Health does not maintain its own housing office; however, additional information on housing may be obtained, on personal application only, from the Harvard University Housing Office, 7 Ware Street, Cambridge, Massachusetts 02138.

## STUDENT HEALTH SERVICE

Under the University Health and Insurance Plan, students at the School of Public Health receive medical care and insurance toward hospital expenses. Medical care is provided through the facilities of the Medical Area Health Service, located in Vanderbilt Hall. The hospitalization insurance extends for a period of twelve months from September 1, and covers hospitalization in Boston and elsewhere. Research and teaching fellows who are in a training status are required to enroll in the Student Health Plan unless they can show that they have comparable coverage.

A prepaid program for the care of spouses (including maternity benefits) and children of full-time students is available. As the plan provides extensive benefits for ambulatory and inpatient care, all who

## **SCHOOL OF PUBLIC HEALTH**

are eligible are strongly advised to enroll. Its coverage, like that of the Student Plan, extends for a period of twelve months from September 1, and provides full semiprivate hospitalization benefits. A descriptive brochure about the plan for dependents is sent to students before registration or may be obtained from the Registrar.

Any illness necessitating absence from classes should be reported to the Medical Area Health Service Office by the student or an attending physician, and to the Registrar's Office at the School. A physician from the Medical Area Health Service, on call twenty-four hours a day, can be reached through the switchboard of Harvard University.

For further information, contact the Director, Medical Area Health Service, 275 Longwood Avenue, Boston, Massachusetts 02115. (Telephone: 734-3300, extension 426).



# Admission and Degree Requirements and Academic Programs

The School of Public Health offers programs leading to the graduate degrees of *Master of Public Health* (M.P.H.), *Doctor of Public Health* (Dr.P.H.), *Master of Industrial Health* (M.I.H.), *Master of Science* in a specified field (S.M. in . . .), and *Doctor of Science* in a specified field (S.D. in . . .). The general degree requirements and the respective requirements for admission are discussed in the following sections.

## **MASTER OF PUBLIC HEALTH**

The program leading to the Master of Public Health degree consists of one academic year of study designed to prepare existing health professionals for careers in public health practice, administration, and research. The program provides a broad background in various disciplines basic to public health. Through the choice of elective courses beyond the basic area requirements, students may acquire a general knowledge of several areas or may pursue in some depth one or more areas of particular relevance to their career goals.

### **Requirements for Admission**

Applicants to the M.P.H. program must satisfy the Committee on Admissions and Degrees as to their academic ability, the relevance of their previous education and experience, and their overall qualifications for graduate professional education in public health. Ordinarily, an applicant should hold a doctoral degree in medicine, dentistry, or veterinary medicine. Consideration is also given to applicants who hold doctoral degrees in biology, behavioral sciences, other natural sciences and social sciences, law, economics, engineering, and certain related fields regarded by the School as appropriate background for entrance into the public health profession.

Students currently enrolled in an M.D. or D.M.D. program may apply for admission to the M.P.H. program — if a joint program can be arranged that meets the approval of both the Committee on Admissions and Degrees and the institution from which the doctoral degree is being earned. Ordinarily, such students are concurrently enrolled at

## SCHOOL OF PUBLIC HEALTH

the Harvard Medical School or the Harvard School of Dental Medicine, but occasionally students from other schools of medicine or dentistry are able to arrange similar programs. For students in a joint degree program, the M.P.H. degree will be conferred in the term in which the doctoral degree is awarded.

In very exceptional instances, consideration for admission to the M.P.H. program may be given to an applicant who holds a master's degree, or, more rarely, a baccalaureate degree, with a highly distinguished academic record, coupled with substantial professional experience in public health or related fields. These applicants must be able to demonstrate sufficient knowledge and competence to satisfy the Committee on Admissions and Degrees as to their qualifications for professional public health education.

### Requirements for the Degree

An M.P.H. degree candidate must spend one academic year in residence at the University and must successfully complete courses totaling a minimum of 40 credit units, at least half of which must be earned at the Harvard School of Public Health. Each M.P.H. student's program must include courses that represent adequate coverage in three basic areas of public health, as outlined below. The extent of coverage in these areas must meet the approval of the Master of Public Health Review Committee.

In a given student's program, no single course shall satisfy the requirement in more than one of the following areas:

1. Fundamental knowledge and concepts about man, with particular attention to his interaction with the (1) physical, (2) biological, and (3) social (including psychological) environment, and the effects of that interaction on his health. *Study programs will ordinarily include introductory courses in at least two of these three subareas.*
2. Basic techniques of investigation, measurement, and evaluation, with emphasis on their use in understanding health in human communities. *Study programs will ordinarily include the introductory courses in biostatistics and epidemiology.*
3. Basic approaches to policy planning and program management and their application to the promotion of community health within the social, economic, and political setting relevant to health services. *Study programs will ordinarily include one of the introductory courses in health services administration.*



## DOCTOR OF PUBLIC HEALTH

The Doctor of Public Health is an advanced professional degree for those who intend to pursue academic or research careers in public health, including administrative, planning, or evaluation roles in public health practice. The degree is granted on successful completion of an approved program of independent and original investigation in a special field of public health and the presentation of the results of this research in an acceptable thesis.

### Requirements for Admission

An applicant for admission to candidacy for the Doctor of Public Health degree normally must be a graduate of an approved school of medicine, dental medicine, or veterinary medicine. Depending on the intended field of specialization, consideration may also be given to a candidate who holds an advanced degree in one of the disciplines basic to public health. In addition, the applicant must hold, or be in progress toward, the degree of Master of Public Health, or its equivalent, from an approved institution.

Applicants must be able to satisfy the Committee on Admissions and Degrees as to their overall qualifications for doctoral study at the School and must demonstrate potential ability to undertake original investigation in a special field.

Admission to doctoral candidacy is considered provisional until the candidate has passed both parts of the qualifying examination.

### Requirements for the Degree

Doctoral candidates are required to complete a minimum of one academic year in residence at the University while enrolled in the doctoral program. However, the required work and preparation of an acceptable thesis normally require at least two full years and frequently longer.

Residence requirements are fulfilled by payment of tuition and pursuit of an approved program. It should be noted that the required year of residence for the doctoral degree is in addition to residence requirements for a master's degree from the School. That is, a year of residence while working toward a master's degree does not fulfill the residence requirement for the doctoral degree.

The first year of doctoral study is almost invariably spent in actual residence at the School. Thereafter, the thesis work may be continued

## SCHOOL OF PUBLIC HEALTH

at the School or, in special circumstances, may be done *in absentia*, under arrangements described farther on.

After the student is enrolled as a provisional doctoral candidate, a doctoral program adviser is appointed by the department or field of concentration. The adviser keeps the student informed of all procedures and requirements for the degree; advises him about proper courses to be taken; decides, together with the department, when the student is prepared to take the qualifying examination; and supervises the thesis work.

*Qualifying Examination.* The qualifying examination for admission to full doctoral candidacy consists of two parts, A and B. Part A may be written, oral, or both. It is administered by the department of concentration and consists of a thorough examination in the field of concentration and in closely related areas.

On satisfactory completion of Part A, the candidate is eligible for Part B. This second part of the qualifying examination is an oral examination in the field of concentration and in at least two other relevant fields. Management of Part B is the responsibility of the Committee on Admissions and Degrees and the Registrar.

Both parts of the qualifying examination should normally be completed within one year of registration as a provisional doctoral candidate.

*Doctoral Evaluation Committee.* After the candidate has passed the qualifying examination, two faculty members are appointed to aid the adviser in the periodic evaluation of the student's progress.

*Thesis.* An acceptable thesis must be submitted within five years of the date of registration as a provisional doctoral candidate. The thesis should consist of one or more manuscripts suitable for publication in a scientific medium appropriate to the candidate's field. If the work is published prior to submission of the thesis, reprints may be submitted in lieu of manuscript.

The thesis must first be accepted by the department of concentration. When it is, three unbound copies should be deposited in the Registrar's Office. On request of the department, the Committee on Admissions and Degrees will appoint three or more readers. When the readers have individually evaluated the thesis, they will meet, together with one or more members of the Committee, and make a joint recommendation regarding acceptance of the thesis. The readers, as individuals or at their meeting, may call on the student for clarification, augmentation, or defense of material presented in the thesis.

## DEGREES AND PROGRAMS

If the thesis is accepted, the Committee on Admissions and Degrees may then recommend the candidate to the Faculty for the degree. The degree is voted by the Faculty at its special meetings in October, February, or June.

The unbound copies of the thesis must be in the Registrar's Office before *September first* for degrees to be awarded in November, before *January first* for degrees to be awarded at midyear, and before *April fifteenth* for degrees to be awarded in June. In order to meet these deadlines, the candidate should submit the completed thesis to his department for approval at least two weeks in advance of these dates.

*Thesis Work in Absentia.* For thesis work done *in absentia*, the adviser and the appointed evaluators must meet with the candidate to appraise the thesis plan. Agreement must be reached and the Committee on Admissions and Degrees must be advised in writing before departure of the student as to: (1) the acceptability and feasibility of the proposed thesis plan; (2) the timing and scope of periodic written reports which will be required of the student; (3) arrangements which have been or can be made for direct field supervision of the student; and (4) the minimum period of time the student will spend at the School before submitting his thesis for appraisal by the readers (a minimum of four months is generally recommended).

*Final Seminar.* There is no formal public thesis defense. However, after acceptance of the thesis by the committee of readers, the department of concentration is responsible for the arrangement of a seminar at which the candidate will present and discuss his thesis work. These seminars are announced throughout the School, and are open to faculty, research staff, and students.

Additional information on doctoral program requirements may be obtained from the Registrar's Office.

## MASTER OF INDUSTRIAL HEALTH

The program leading to the Master of Industrial Health degree is designed to provide physicians with postgraduate training in the public health disciplines that are relevant to the development of preventive medical programs in industry. This one-year degree program may be taken as part of a two-year approved residency in occupational medicine, or it may be taken as an independent one-year program.

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### Requirements for Admission

Candidates must be graduates of an approved school of medicine and must satisfy the Committee on Admissions and Degrees as to their scholastic ability to study at the graduate level. Students from the United States must have completed an internship or residency of at least twelve months in a hospital approved by the American Medical Association.

### Requirements for the Degree

Candidates for the M.I.H. degree must spend one academic year in residence at the University and must successfully complete a program of at least 40 credit units, comprising both required and elective courses.

All candidates are expected to take the following courses unless they can demonstrate equivalent preparation:

<i>Course</i>	<i>Credit Units</i>
Principles of Biostatistics (Biostatistics 101a,b)	3.5
Principles of Epidemiology (Epidemiology 201a)	2.5
Principles of Environmental Health (Environmental Health Interdepartmental 201a,201b)	5
Introduction to Radiation Protection (Environmental Health Sciences 271a,b)	5
Basic Problems in Occupational Health and Industrial Environments (Environmental Health Sciences 251c,d)	5
Total:	<hr/> 21

Additional courses may be selected from the curriculum approved for residencies in occupational medicine.

**MASTER OF SCIENCE IN SPECIFIED FIELD**

The School offers one-year and two-year programs leading to the degree of Master of Science in designated fields of concentration. In general, these programs are designed for students with interests in the scientific basis of public health and preventive medicine. These degrees are granted upon fulfillment of a program of advanced work in one of the public health disciplines represented by departments and certain programs in the School. The Master of Science degrees currently conferred by the School include:

- Master of Science in Behavioral Sciences
- Master of Science in Biostatistics
- Master of Science in Environmental Health Sciences
- Master of Science in Epidemiology
- Master of Science in Health Policy and Management
- Master of Science in Health Services Administration
- Master of Science in Maternal and Child Health
- Master of Science in Microbiology
- Master of Science in Nutrition
- Master of Science in Physiology
- Master of Science in Population Sciences
- Master of Science in Tropical Public Health

Occasionally, students may be admitted to a program in which more than one of the above disciplines are combined in such a fashion as to meet the requirements of the programs or departments involved. In such instances, the degree conferred specifies the areas.

The above degrees are conferred upon completion of either a one-year or a two-year program, depending upon requirements of the respective programs. Programs leading to these degrees are described later in this section, following the general statement of admission and degree requirements. Requests for additional information about specific programs should be directed to the respective departments, as indicated in the degree designation.

**Requirements for Admission**

Applicants to Master of Science degree programs must satisfy the Committee on Admissions and Degrees as to their overall qualifications and promise for successful graduate study at the School. Appli-



## SCHOOL OF PUBLIC HEALTH

cants must also satisfy the department or program to which admission is sought that they have an adequate academic and/or professional background appropriate for specialization in that field.

Conditions of eligibility for one-year or two-year programs vary with the area or department in which a student wishes to specialize. Prospective applicants should consult program descriptions for more specific information.

Generally, eligibility for admission to a one-year program is limited to graduates of approved schools of medicine, dentistry, or veterinary medicine, or to applicants who have earned doctoral or, for some programs, master's degrees in fields acceptable to the department(s) to which admission is sought. Applicants holding master's degrees may be considered for admission to one-year or to two-year programs, depending upon their prior educational and professional background and upon the particular requirements of the program to which they wish to apply.

An applicant holding a baccalaureate degree is normally considered for admission to a two-year program, in order to complete the requirements for a Master of Science degree. For a few programs, including industrial hygiene, air pollution control, and radiological health, applicants may be considered for a one-year program if they hold a bachelor's degree with adequate scientific and engineering training and if they have had at least two years of relevant professional experience in the field of specialization.

Occasionally, a year or more of appropriate graduate work in an approved institution may enable a student to fulfill two-year program requirements in one year. In some cases, however, program requirements are such that a student must spend one-and-a-half or two years in residence in order to complete the necessary courses, regardless of his prior training and experience.

*Graduate Record Examination.* All candidates for admission to a Master of Science program are required to submit scores for the Aptitude Test of the Graduate Record Examination unless they have previously earned doctoral degrees. An Advanced Test of the Graduate Record Examination may be required in some programs if the applicant's undergraduate major is in one of the following fields: biology, chemistry, economics, engineering, mathematics, physics, political science, psychology, or sociology. Applicants are advised to take the Graduate Record Examination no later than the January test administration date. Additional information concerning the Graduate

Record Examination requirement is included in the instructions accompanying the application form.

### **Requirements for the Degree**

Students admitted to a one-year program must spend a minimum of one year in residence at the University and must successfully complete a program of at least 40 credit units. Students admitted to a two-year program must spend two years in residence and must successfully complete a program of at least 80 credit units.

While specific course requirements vary from program to program, all candidates for a Master of Science degree are required to take Biostatistics 101a,b and Epidemiology 201a, unless they can demonstrate equivalent preparation. Candidates who do not have a background in medicine or biology are advised to take Physiology 203a,b, or its equivalent, or a course in general biology elsewhere. Beyond these minimal course requirements, each program may specify additional courses that are necessary for satisfactory fulfillment of degree requirements in the particular area of specialization. These specific course requirements are generally *not* listed in this catalog. The student should consult with his adviser or department or program head about these requirements before deciding which courses to take.

Additional information about Master of Science programs in particular areas is included in the following program descriptions.

### **Master of Science in Behavioral Sciences**

Two programs lead to the degree of *Master of Science in Behavioral Sciences*. The first is a general concentration in the behavioral sciences geared to the individual interests of students. The second program is designed to prepare physicians in the techniques of psychiatric epidemiology.

*One-Year Program in Behavioral Sciences.* The goal of this program is to develop skills in applied behavioral sciences — e.g., medical sociology, psychosomatic medicine, methodology in behavioral techniques such as small-group processes — for use in administration and planning of health programs. The program is regarded as a terminal master's degree program for the majority of students, most of whom assume nonresearch administrative positions upon receipt of the S.M. degree.

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Preferred candidates for admission to the program are physicians or persons with a minimum of a master's degree in the biological or social sciences. The curriculum is flexible, with wide latitude for individual differences in the selection of courses and overall program design, although the majority of courses are elected from the offerings of the Department of Behavioral Sciences.

*Psychiatric Epidemiology.* The goals of this program are: (1) to train students in the methods of psychiatric epidemiology for use in basic and applied research, and (2) to develop the conceptual skills of mental health administrators in using psychiatric epidemiology in program planning, delivery, and evaluation of services. It is a one-year S.M. program, terminal for most graduates, of whom roughly half assume positions involving research and/or evaluation of programs, and half become involved in the administration of mental health services.

Candidates preferred for admission to the program hold M.D. degrees (preferably with a residency in psychiatry) or Ph.D. degrees in psychology, anthropology, or perhaps a related social science. Occasionally, students with master's degrees in psychology or anthropology are accepted into the program.

### **Master of Science in Biostatistics**

The program leading to the degree of *Master of Science in Biostatistics* is primarily a two-year curriculum geared to students with a prior bachelor's degree who have extensive training in mathematics. Occasionally students with a prior year of graduate work enroll and are able to complete the program in one year.

The goal of the program is to prepare students for doctoral-level study for careers in biostatistical research and teaching. Applicants are screened for their potential for doctoral study, and most continue toward the doctorate.

Approximately half of each student's program consists of courses in statistics and epidemiology at the School of Public Health and at the Graduate School of Arts and Sciences. Other courses elected vary with the particular needs and background of individual students, although students are often advised to take general courses in human physiology, human biology, and, occasionally, courses in pathology and immunology. By the second year of the program, the student develops specific interests and elects, under advisement, more intensive courses related to his particular areas of interest.



For students not immediately interested in a doctoral program, the Department of Biostatistics offers a two-year terminal S.M. degree. This may be combined with a program in another department. Both departments would be involved in the admission process and the development of suitable programs.

### **Master of Science in Environmental Health Sciences**

There are five specialized programs leading to the degree of *Master of Science in Environmental Health Sciences*. Although an occasional student is admitted to a general program in environmental health sciences, for which courses may be planned to suit individual student interests and career goals, the majority of students elect one of the specialties described below.

Problem analyses and the evaluation and reporting of such analyses are expected to be major components of the work of health professionals who graduate from these programs. To assure the development of these skills, each student accepted into a two-year master's program will be required to conduct an appropriate research or related study and to present a written report on it at an acceptable professional level. Such studies and the associated reports will generally be completed during the second year of the program. The minimum time devoted to this effort will be 5 credit units per semester, for a total of 10 credit units.

*Air Pollution Control.* This program provides preparation in the sciences basic to understanding air pollution research and control activities. The curriculum generally includes courses in community air pollution, meteorological aspects of air pollution, identification and measurement of air contaminants, air and gas cleaning, aerosol technology, and principles of toxicology. Upon receipt of the S.M. degree, most graduates secure positions with federal, state, or local regulatory agencies, with consulting firms, or with industry.

Acceptable candidates for the program normally have a bachelor's degree in engineering (preferably chemical engineering), chemistry, mathematics, or physics. Although this is primarily a two-year program, students with master's degrees in the forenamed disciplines, and some students with prior training or experience in related areas, may be able to complete the program in one year.

*Environmental Health Management.* The principal goal of this program is to train professional public health personnel to manage environmental health problems, particularly in urban areas. The pro-

## SCHOOL OF PUBLIC HEALTH

gram is multidisciplinary and draws upon courses offered by the Harvard School of Public Health, by other faculties of Harvard University, and by the Massachusetts Institute of Technology. Students normally take a series of courses in air pollution control, industrial hygiene, radiological health (specialty areas offered through the Department of Environmental Health Sciences), or water pollution control (offered through the Division of Engineering and Applied Physics of the Graduate School of Arts and Sciences), supplemented by course work in environmental economics, public health administration, political and social sciences, environmental law, environmental planning, and health education.

The program is usually two years in length and includes a mandatory field training assignment with an environmental health agency during the intervening summer. Students admitted to the program normally hold a bachelor's degree in biology, engineering, geology, or another science. Most S.M. degree recipients enter nonresearch positions in the environmental control field.

*Industrial Hygiene.* The program in industrial hygiene is designed to help meet the demand for professional personnel with the skills and scientific knowledge that are needed to identify health problems — e.g., air contamination, noise, radiation, heat, pressure — that exist in the workplace. The curriculum generally includes recommended and/or required courses dealing with basic problems in occupational health and industrial environments, environmental control, identification and measurement of air contaminants, air and gas cleaning, principles of toxicology, and aerosol technology.

The program is usually two years in length, after which most S.M. degree recipients become professionals in government, industrial, insurance, and academic settings. Students admitted to the program normally have prior bachelor's degrees in engineering (usually chemical engineering) or in biology or chemistry.

*Medical Radiological Physics.* This program is designed to provide students with a large portion of the knowledge and experience necessary for the practice of radiological physics in a hospital and for certification by the American Board of Radiology. It is primarily a two-year program, after which many students continue toward a doctorate. Approximately half of the graduates of this program enter research careers; the remainder enter nonresearch careers, principally as radiological physicists in health-care settings. Program

trainees normally have prior bachelor's or master's degrees in physics and mathematics.

The program utilizes the resources of the Harvard teaching hospitals and was designed in collaboration with the recently established Harvard-M.I.T. Program in Health Sciences and Technology. The curriculum draws upon courses within that program as well as courses offered within the Harvard School of Public Health. A typical curriculum might include recommended and/or required courses in radiation protection, radiation biology, X-ray protection, radiation dosimetry, and physics in diagnostic radiology, nuclear medicine, and radiation therapy.

*Radiological Health (Radiation Protection).* Students in this program are provided with knowledge of the fundamentals of radiation protection. Considerable attention is given to the effects of environmental releases of radioactive materials, and the associated requirements for complying with regulations and standards. The curriculum includes recommended and/or required courses in radiation protection, radiation biology, radiation protection engineering, X-ray protection, aerosol technology, and radiation dosimetry.

Recipients of the S.M. degree are prepared for positions with the nuclear power industry, hospitals, universities, research institutions, governmental regulatory agencies, and consulting architectural or engineering firms. Students admitted typically have prior bachelor's or master's degrees in physics, mathematics, or engineering. The program normally requires two years, although some students with prior training and/or experience in relevant areas may complete the program in one year.

### **Master of Science in Epidemiology**

Two programs lead to the degree of *Master of Science in Epidemiology*. A one-year program is offered for physicians, veterinarians, dentists, and students with prior master's degrees in a relevant field. The second program is a recently established two-year program designed to prepare recent undergraduates who have strong backgrounds in biology and mathematics for careers in epidemiologic research.

*One-Year Program.* The one-year program is intended to provide students (primarily physicians) with basic skills in epidemiologic and quantitative methods and in computing, in preparation for research careers. The program usually includes most of the courses offered by

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the Department of Epidemiology, plus courses in principles of biostatistics, statistical methods in research, and computing principles and methods which are offered by the Department of Biostatistics (a total of 25 to 30 credit units). Additional formal courses in areas of special interest and/or supervised research comprise the remainder of the program. Approximately half of the S.M. degree recipients continue toward the doctorate, while others enter research work.

*Two-Year Program.* The two-year program is designed for persons who hold a bachelor's degree and have a strong background in biology and mathematics. In addition to the epidemiology and statistics courses listed under the one-year program, students take courses in basic medical sciences and the biological aspects of public health problems. The program is intended for students who will continue toward a doctorate.

### **Master of Science in Health Policy and Management**

The program leading to the degree of *Master of Science in Health Policy and Management* is an interdisciplinary, two-year program which prepares students for careers in health planning and regulation or in the administration of health programs and institutions. Students holding baccalaureate degrees with strong academic backgrounds in the natural or social sciences are eligible to apply. The program encourages application from candidates with prior training as health professionals and/or some work experience in the health field. All applicants must demonstrate ability to master the quantitative and analytical content of the program.

A set of core courses comprises less than half of each student's program. These courses cover basic health issues and institutions, quantitative methods, epidemiology, economics of health policies and programs, and sociological and historical perspectives on health care. (Descriptions of these courses may be found under "Department of Epidemiology," "Interdepartmental Courses," and "Department of Health Services.") Beyond the core courses, students may concentrate their studies in one of three ways: on policy skills; on management skills; or on a substantive health problem area, examining both planning and administrative aspects of that area. In addition to courses at the School of Public Health, students may select appropriate courses offered by other faculties at Harvard and by the Massachusetts Institute of Technology. Supervised field work (in the summer between years one and two and in the second year) is an integral

part of the program. Students are exempted from required courses where they can demonstrate prior proficiency and, in exceptional circumstances, the period of study required for the degree may be reduced.

### **Master of Science in Health Services Administration**

A one-year program is currently offered which leads to the degree of *Master of Science in Health Services Administration*. Its goal is to give students a broad understanding of the health services system while developing their abilities to address issues and problems analytically and to carry out rational approaches to problem solving.

Students admitted to the program generally hold medical degrees or master's degrees in disciplines related to health or administration, and preferably have had relevant work experience. Approximately two-thirds of the S.M. program graduates enter administrative positions, while others continue toward a doctorate.

The curriculum is designed with sufficient flexibility to permit a student to direct his or her program toward particular health areas. Courses offered by the division of health services administration of the Department of Health Services normally constitute a substantial portion of each student's program.

### **Master of Science in Maternal and Child Health**

The program leading to the degree of *Master of Science in Maternal and Child Health* is primarily a one-year program for students with prior master's degrees in nursing, social work, or nutrition, or M.D. degrees, preferably with professional experience in a public health agency or health-care program, or research experience in child growth and development. The program provides knowledge of the principles of administration of health services for mothers and children, and skills for determining needs, designing services, and planning health programs for mothers and children and for other special groups (e.g., handicapped persons).

Most S.M. degree recipients enter nonresearch administrative positions, and some continue toward a doctorate. Most students elect basic courses offered by the divisions of maternal and child health and health services administration of the Department of Health Services. However, the curriculum is flexible, with latitude for course selection tailored to individual interests.



### **Master of Science in Microbiology**

Programs leading to the degree of *Master of Science in Microbiology* are offered in the following areas: cancer biology; immunology; management of communicable disease laboratories; medical mycology and immunology; rickettsiae and chlamydiae; and virology. Unless otherwise indicated, these programs are designed for students who intend to continue toward the doctoral degree. Applicants will be selected on the basis of their interest in, and potential for, continuation in doctoral study. For admission, a minimum of a bachelor's degree in microbiology, biochemistry, cell biology, and/or other related areas is required. Such students generally require two years to earn the S.M. degree. Applicants with prior doctoral degrees (M.D., D.V.M., D.M.D., or Ph.D. in a related area) or master's degrees in a related area are also qualified for admission, and are normally able to complete these master's programs in one year. These programs prepare students for careers in research and teaching at the graduate level.

*Cancer Biology.* Study programs emphasize independent research and focus primarily on viral oncology and tumor immunology. Development in the related areas of cancer epidemiology, cell and radiation biology, and cellular immunology is encouraged.

*Immunology.* This program develops in students the scientific background and laboratory skills needed in original research. It is based on current research in the Department of Microbiology. Applied research in infectious diseases is directed toward the chlamydiae, rickettsiae, fungi, and gonococci. Basic research problems include cell interaction, enhancement and suppression phenomena, antigen characterization, and quantitative immunochemistry. The Department has specific interests in the basic and applied aspects of the secretory immune system. Research in tumor immunology includes the immunobiology of oncogenic viruses and immunosuppression phenomena.

*Management of Communicable Disease Laboratories.* Launched in 1974, this program prepares students with prior doctoral degrees (M.D., D.M.D., D.V.M., or Ph.D. in medical microbiology) for careers in laboratory management. The goal of the program is to develop administrative and management skills required in the direction of large communicable disease laboratories; these include techniques of specimen transmission, data handling, epidemiological evaluation, quality control, budgeting, recruitment, personnel and on-line man-



agement, together with knowledge of requirements for certification by state and federal agencies. Upon receipt of the S.M. or M.P.H. degree, graduates generally assume management positions in public health laboratory settings, in large hospitals, or in prepaid health care delivery systems.

Although the curriculum requires two years of residency, the breadth of the program is such that the requirements for a Master of Public Health degree may be met. Hence, most students have the option of applying for candidacy for either the *Master of Public Health* or the *Master of Science in Microbiology* degree.

*Medical Mycology and Immunology.* The program develops basic skills in laboratory techniques and data handling for conducting original research under direction, as well as grounding students in infectious disease etiology and control. In addition to taking courses in microbiology and tropical public health, students acquire a background in histology and pathology and engage in a related 350-level research project, normally during the second year of the program. Most of the program graduates continue toward the doctorate upon receipt of the S.M. degree; those who discontinue study may enter either research positions or positions as clinical mycologists.

*Rickettsiae and Chlamydiae.* This program provides intensive training in laboratory techniques, data handling, and research methodology as the groundwork for independent research. It includes studies on the biology, immunology, and epidemiology of rickettsial and chlamydial diseases. Present field and laboratory rickettsial disease projects include Rocky Mountain spotted fever in the United States and louse-borne typhus in Yugoslavia. Chlamydial projects in progress include study of trachoma and nongonococcal urethritis in man and a sexually transmitted chlamydial infection in guinea pigs which is being developed as a model for the study of sexually transmitted diseases in man.

Under the auspices of the Center for Study of Sexually Transmitted Diseases, the student may undertake clinical, epidemiological, or laboratory research in a unit of the Center with one or more of the following sexually transmitted organisms: treponemes, gonococci, mycoplasma, chlamydiae, streptococci, candida, and herpesviruses (including cytomegaloviruses). The program includes opportunities for study of the immunological responses of the host to these agents.

*Virology.* Students in this program are directed toward laboratory research in viral oncology, environmental virology, viral immunology,

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or viral epidemiology. Research programs may be either basic or applied in nature, depending on the student's interests and career goals.

### **Master of Science in Nutrition**

The program leading to the degree of *Master of Science in Nutrition* is a flexible program that can be adapted to the background and career interests of individual students. Its general goal is to provide basic information in nutrition and to develop basic skills in laboratory techniques and data handling for undertaking original research under direction. Students are normally expected to take courses in public health nutrition, nutrition policy, and the biochemistry and physiology of nutrition, as well as the departmental seminar and an acceptable course in biochemistry.

The program is perceived as preparation for doctoral study. Students with bachelor's degrees in biology, chemistry, or nutritional sciences normally require two years to complete the S.M. program requirements, while students with master's or higher degrees in such fields as biochemistry, physiology, or other related fields usually complete the program in one year.

### **Master of Science in Physiology**

At present, there are three areas of specialization in which programs are offered leading to the degree of *Master of Science in Physiology*: environmental or respiratory physiology; radiobiology; and toxicology. A fourth program, in occupational medicine, may lead either to the degree of *Master of Science in Physiology* or to the degree of *Master of Industrial Health* (M.I.H.).

*Environmental or Respiratory Physiology.* This is a fairly structured two-year program, primarily for students with prior bachelor's degrees in the physical sciences, or in biology with a strong physical science and mathematical component, who intend to continue toward a doctorate.

As a predoctoral program, the curriculum is aimed at providing students with substantive knowledge of respiratory physiology as a special field within organismic physiology, based on cell biology, biochemistry, biophysics, and biomathematics. The program is also designed to assist students in developing skills necessary for performing research in respiratory mechanics, respiratory defense

mechanisms, and pathophysiology of respiratory disease; these include skills in statistics, experimental design, bioinstrumentation, and computation.

*Radiobiology.* This program is intended to prepare students with prior background in biology and/or physics for doctoral study, as the basis for research careers in radiation biology and experimental carcinogenesis. Its goal is to offer the academic preparation and develop the basic skills in laboratory techniques and data handling necessary for undertaking original research. It is designed as a two-year program, which some students with master's degrees in related areas (e.g., biology, radiation biology, biochemistry) may complete in one year. The majority of students continue toward a doctorate; those who have discontinued study after receiving the S.M. degree have entered research- or service-oriented careers in radiological health.

*Toxicology.* The program in toxicology is a two-year program intended primarily for students with recent baccalaureate degrees in biology or chemistry. It provides systematic knowledge of the health implications of environmental chemicals, combined with the in-depth knowledge of basic biomedical sciences necessary for subsequent doctoral research in a specific area. Most of the students continue in doctoral study and enter research or academic careers upon receipt of the doctoral degree.

The curriculum is fairly structured in both years of the program. Students with prior master's degrees and background in relevant areas may be able to complete the program in one year.

*Occupational Medicine or Master of Industrial Health (M.I.H.).* The program in occupational medicine is strictly a one-year program for physicians and may lead either to the degree of *Master of Science in Physiology* or to the *Master of Industrial Health* degree described elsewhere. The goal of the program is to prepare physicians for both theoretical and practical aspects of careers in occupational medicine as a special field of preventive medicine and public health. In one year only part of this goal can be achieved — to provide the student with basic knowledge of industrial processes and hazards; illnesses and impairments associated with occupations; control of occupational hazards; and similar topics. Minimum skills are expected in epidemiologic and statistical methods, environmental assessment and monitoring, and related techniques.

The student is expected to continue in doctoral status or in residency training, primarily in epidemiologic aspects of occupational

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medicine. Upon completion of the residency phase, the student is eligible for certification by the American Board of Preventive Medicine.

### **Master of Science in Population Sciences**

There is wide variability among the programs of individual candidates for the degree of *Master of Science in Population Sciences*, reflecting the diversity of the students' backgrounds, national origins, previous education, areas of professional concern, and career goals. Given these varied curriculum needs, the overall goals of the program are to develop sophistication in data and information management and evaluation, as well as to provide a broad philosophical perspective on problems and issues in the population field.

Students with bachelor's degrees in biological and/or social sciences, or in other population-related fields, are generally expected to spend two years in residence toward the S.M. degree. Students with prior master's or higher degrees, or extensive work experience, generally complete study toward the S.M. degree in one year.

### **Master of Science in Tropical Public Health**

There are four programs leading to the degree of *Master of Science in Tropical Public Health*. Two are basically one-year programs — tropical public health, and medical and public health virology. The other two — ecology and control of vectors of disease, and medical and public health parasitology — are primarily two-year programs.

*Tropical Public Health.* This one-year program is designed for students with prior medical degrees (M.D., D.V.M., D.M.D., D.D.S.) or doctoral degrees in biomedical science who are interested in problems of infectious disease in developing countries. The program has the following goals: (1) to provide students who have adequate training in the health sciences with the additional background essential for careers in research or service in developing countries; (2) to introduce students to the significance, recognition, and prevention of the major infectious disease problems of developing countries; and (3) to introduce them to the factors influencing human ecology and social development in such areas.

*Medical and Public Health Virology.* This is primarily a one-year program geared to students with prior medical degrees, doctorates in

microbiology or associated fields, or master's degrees in basic biological sciences, biology, or microbiology. Students deficient in specific requisite areas may be required to spend a second year in residence.

The program is regarded as predoctoral training for students interested in careers in teaching and research in the area of medical virology. Most graduates continue toward a doctorate. The goals of the program are to provide familiarity with technical procedures needed in the study of immunopathogenesis of human viral pathogens, and to introduce students to problems of control of endemic and epidemic viral diseases in human populations.

*Medical and Public Health Parasitology.* Students with prior M.D. degrees or doctoral or master's degrees in biological or medical sciences are eligible for admission to this program. The exceptional candidate with a strong biological background but lacking a master's degree will be considered. For the student without prior preparation in pathology, biochemistry, and immunology, two years of course work are customary; students with sufficient prior preparation may complete the program in one year. The program is regarded as preparation for doctoral study, eventually leading to careers in research and teaching in the area of medical parasitology.

The goals of the program are: (1) to acquaint the student with recent advances in the area of parasitic diseases and with the present status of such diseases throughout the world; (2) to develop skills for evaluation of the current literature and of control programs; and (3) to provide adequate background for conducting research on these diseases, including their biochemical and immunological aspects.

*Ecology and Control of Vectors of Disease.* This is primarily a two-year predoctoral program, which some students with previous education in relevant areas may complete in one year. Students admitted to the program normally have prior medical degrees or doctorates or master's degrees in biological or medical sciences. Almost all S.M. recipients continue toward a doctorate, in preparation for a career in teaching and research.

The specific educational goals of the program are: (1) to acquaint the student with the various arthropod and molluscan vectors of disease and to develop an appreciation of the biology of these organisms and the means for their control; (2) to prepare the student to plan and evaluate control programs; and (3) to develop skills with respect to identification, maintenance, and experimental procedures involving these organisms.



## DOCTOR OF SCIENCE IN SPECIFIED FIELD

The Doctor of Science degree is an advanced graduate degree for those who intend to pursue academic or research careers in public health. The degree is granted on successful completion of a program of independent and original research in one of the basic disciplines of public health, and upon the presentation of this research in an acceptable thesis.

Doctor of Science degrees currently conferred by the School include:

- Doctor of Science in Behavioral Sciences
- Doctor of Science in Biostatistics
- Doctor of Science in Environmental Health Sciences
- Doctor of Science in Epidemiology
- Doctor of Science in Health Services Administration
- Doctor of Science in Maternal and Child Health
- Doctor of Science in Microbiology
- Doctor of Science in Nutrition
- Doctor of Science in Physiology
- Doctor of Science in Population Sciences
- Doctor of Science in Tropical Public Health

Occasionally, a student may be admitted to candidacy for a doctoral degree in more than one discipline, if the program meets the requirements of the respective departments or programs involved.

### Requirements for Admission

Applicants for admission to candidacy for one of the above Doctor of Science degrees must satisfy the Committee on Admissions and Degrees and the department of specialization as to their overall qualifications for doctoral study and their ability to undertake original research in their chosen field. All candidates for a Doctor of Science degree must hold the degree of Master of Science or its equivalent. In some instances, an applicant whose prior degrees were earned at another institution will be expected to complete the Master of Science degree at the School before being granted full admission to doctoral study. In such cases, the student will first be admitted to a Master of Science program. (It should be noted that applicants to doctoral programs may be required to take the Aptitude Test of the Graduate Record Examination as part of the admissions process.)



Because specific prerequisites vary with the discipline or field of specialization, prospective applicants are urged to write to the department or program to which admission is sought for more detailed information.

In every case, admission to doctoral candidacy is considered provisional until the candidate has passed both parts of the qualifying examination.

### **Requirements for the Degree**

Doctoral candidates are required to complete a minimum of one academic year in residence at the University while enrolled in the doctoral program. However, the required work and preparation of an acceptable thesis normally require at least two full years and frequently longer.

Residence requirements are fulfilled by payment of tuition and pursuit of an approved program. It should be noted that the required year of residence for the doctoral degree is in addition to residence requirements for a master's degree from the School. That is, a year of residence while working toward a master's degree does not fulfill the residence requirement for the doctoral degree.

The first year of doctoral study is almost invariably spent in actual residence at the School. Thereafter, the thesis work may be continued at the School or, in special circumstances, may be done *in absentia*, under arrangements described farther on.

After the student is enrolled as a provisional doctoral candidate, a doctoral program adviser is appointed by the department or field of concentration. The adviser keeps the student informed of all procedures and requirements for the degree; advises him about proper courses to be taken; decides, together with the department, when the student is prepared to take the qualifying examination; and supervises the thesis work.

**Qualifying Examination.** The qualifying examination for admission to full doctoral candidacy consists of two parts, A and B. Part A may be written, oral, or both. It is administered by the department of concentration and consists of a thorough examination in the field of concentration and in closely related areas.

On satisfactory completion of Part A, the candidate is eligible for Part B. This second part of the qualifying examination is an oral examination in the field of concentration and in at least two other relevant fields. Management of Part B is the responsibility of the Committee on Admissions and Degrees and the Registrar.

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Both parts of the qualifying examination should normally be completed within one year of registration as a provisional doctoral candidate.

*Doctoral Evaluation Committee.* After the candidate has passed the qualifying examination, two faculty members are appointed to aid the adviser in the periodic evaluation of the student's progress.

*Thesis.* An acceptable thesis must be submitted within five years of the date of registration as a provisional doctoral candidate. The thesis should consist of one or more manuscripts suitable for publication in a scientific medium appropriate to the candidate's field. If the work is published prior to submission of the thesis, reprints may be submitted in lieu of manuscript.

The thesis must first be accepted by the department of concentration. When it is, three unbound copies should be deposited in the Registrar's Office. On request of the department, the Committee on Admissions and Degrees will appoint three or more readers. When the readers have individually evaluated the thesis, they will meet, together with one or more members of the Committee, and make a joint recommendation regarding acceptance of the thesis. The readers, as individuals or at their meeting, may call on the student for clarification, augmentation, or defense of material presented in the thesis.

If the thesis is accepted, the Committee on Admissions and Degrees may then recommend the candidate to the Faculty for the degree. The degree is voted by the Faculty at its special meetings in October, February, or June.

The unbound copies of the thesis must be in the Registrar's Office before *September first* for degrees to be awarded in November, before *January first* for degrees to be awarded at midyear, and before *April fifteenth* for degrees to be awarded in June. In order to meet these deadlines, the candidate should submit the completed thesis to his department for approval at least two weeks in advance of these dates.

*Thesis Work in Absentia.* For thesis work done *in absentia*, the adviser and the appointed evaluators must meet with the candidate to appraise the thesis plan. Agreement must be reached and the Committee on Admissions and Degrees must be advised in writing before departure of the student as to: (1) the acceptability and feasibility of the proposed thesis plan; (2) the timing and scope of periodic written reports which will be required of the student; (3) arrangements which have been or can be made for direct field supervision of the student; and (4) the minimum period of time the student will spend at the

School before submitting his thesis for appraisal by the readers (a minimum of four months is generally recommended).

*Final Seminar.* There is no formal public thesis defense. However, after acceptance of the thesis by the committee of readers, the department of concentration is responsible for the arrangement of a seminar at which the candidate will present and discuss his thesis work. These seminars are announced throughout the School, and are open to faculty, research staff, and students.

Additional information on doctoral program requirements may be obtained from the Registrar's Office.

### **COMBINED DEGREE PROGRAMS WITH MEDICAL AND DENTAL SCHOOLS**

In response to trends in medical school curricula and the increasing interest of medical students in community medicine and public health, the School offers admission to the Master of Public Health or Master of Science programs as part of a combined degree program. The medical or dental student admitted to this program can satisfy requirements for a public health degree within the four years usually required for the Doctor of Medicine or Doctor of Dental Medicine degree. Ordinarily, such students are concurrently enrolled at the Harvard Medical School or the Harvard School of Dental Medicine, but occasionally students from other schools of medicine and dentistry are able to arrange similar programs.

Students from medical schools other than Harvard normally enroll full time for an academic year, after completion of at least two years of medical school. Harvard students are eligible for consideration after completion of one year at the Medical School or the School of Dental Medicine. Such students usually enroll full time for the fall term of their third year and complete requirements for a public health degree either by enrolling full time in the spring term or by spreading their electives in public health over a longer period.

The Master of Public Health or Master of Science degree will be awarded by the Harvard School of Public Health in the term in which the candidate will receive the doctoral degree.

### **RESIDENCY FOR BOARD CERTIFICATION**

The School offers approved residency training leading to certification by the American Board of Preventive Medicine in the following areas:

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General Preventive Medicine, in the specialty areas of  
Epidemiology  
International Health  
Health Services Administration  
Occupational Medicine

Residency credit is given for one or two years of study leading to the Master of Public Health or Master of Science degree, and one or two years of more advanced work including supervised experience which may or may not be part of a doctoral program.

Further details on the residency programs can be obtained from Dr. James L. Whittenberger, Associate Dean and Head of the Department of Physiology.

None of the residencies as such involves stipend or other financial support. Some financial support may be available through traineeships or National Research Service awards for degree programs (U.S. citizenship or permanent residence status required). Further information on financial aid can be obtained from:

Dr. Brian MacMahon (Professor and Head, Department of Epidemiology)

Dr. James L. Whittenberger (Professor and Head, Department of Physiology)

Ms. Margaret C. Salmon (Financial Aid Officer)

## **POSTDOCTORAL FELLOWSHIP PROGRAM IN DENTAL PUBLIC HEALTH AND ECOLOGY**

The School of Dental Medicine, in cooperation with the School of Public Health and the Massachusetts Department of Public Health, offers a program covering three academic years of postdoctoral study, intended to prepare a limited number of individuals for creative full-time teaching, research, or administrative careers in dental public health and dental ecology. Each person accepted into the program will be appointed as a Clinical or Research Fellow in Dental Ecology at the School of Dental Medicine. The program is open to dentists, dental hygienists, and other qualified health professionals.

The program is in three parts of approximately one year each, which need not be completed in succession. One part of the program involves a formal course leading to a degree of Master of Public Health.

## DEGREES AND PROGRAMS

Candidates with an M.P.H. or equivalent from another school, however, may be accepted into the program with one year advanced standing. The second portion involves a one-year supervised residency at the state or community level, in cooperation with the Massachusetts Department of Public Health. This residency meets the requirements of the American Board of Dental Public Health. The third portion affords opportunity for advanced didactic work and research at the School of Dental Medicine, the School of Public Health, other departments of the University, and/or other institutions. Epidemiological or other research work can be carried on over the entire three-year period in a variety of situations involving either new or continued studies. A research thesis is prepared for presentation at the end of the third year.

Fellows in Dental Ecology who wish to become candidates for a degree in public health must meet the admission requirements of the respective programs in the School of Public Health and must submit an application.

Upon successful completion of this program, the candidate may receive the M.P.H. degree from the School of Public Health, as well as a Certificate of Postdoctoral Study in Dental Ecology and a certificate of completion of residency requirements from the Harvard School of Dental Medicine.

Academic study beyond the master's level may be arranged with the School of Public Health and other departments of the University.

For further information and application forms, write to Dr. James M. Dunning, Acting Head, Department of Dental Ecology, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, Massachusetts 02115.



# Departments and Courses of Instruction

In the course listings below, course numbers from 100 to 199 indicate undergraduate and graduate courses; numbers from 200 to 299 indicate primarily graduate courses; and numbers from 300 to 399 indicate graduate courses of reading and research.

The letters "a," "b," "c," "d," and "e" following the course number indicate the period(s) in which a course is given, with "a" denoting first period, "b" second period, "c" third period, and "d" fourth period. The letter "e" indicates supervised special studies or field observations, usually during the one-week period between fall and spring terms or during the post-class period following the spring term.

The credit assignment is given in units following the statement of number and length of sessions per week. The phrase "Additional credit may be arranged" indicates that the student may earn additional credit by attending supplementary class meetings, doing extra reading, or otherwise devoting additional time to the course.

## INTERDEPARTMENTAL COURSES

### **Interdepartmental 201c. History and Philosophy of Public Health**

Lectures. *One 2-hour session each week. 1 unit. Additional credit may be arranged.* Dr. Rosenkrantz.

Not given in 1976-77.

The course has two major purposes: to help the student of public health gain a picture of the development of his profession, and to use selected historical situations to illustrate how scientific knowledge has interacted in the past with political structure, economic status, and cultural attitudes in the determination of the health goals of various societies and the execution of programs.

### **Interdepartmental 202. Introduction to Teaching of Community Medicine and Public Health**

*Self-instructional course, supplemented by small-group discussion. May be taken any period. 2 units.* Dr. Segall, Dr. Vanderschmidt.

This course is designed for students who are preparing for careers in the education of health professionals. A systematic approach to curriculum design is presented through a model program, which includes analysis of professional responsibilities, specification of educational objectives, evaluation of instructional processes, and outcomes and design of learning activities. Examples are drawn primarily from the fields of community medicine and public health.

Enrollment is subject to the approval of the instructors.

### **Interdepartmental 203. Curriculum Design**

*Self-instructional course, supplemented by small-group discussion. May be taken second, third, or fourth period. 2 units.* Dr. Segall, Dr. Vanderschmidt.

This course is recommended for students who currently hold faculty appointments in health professions schools, or who have reasonable



## INTERDEPARTMENTAL COURSES

assurance of such an appointment upon completion of training. Using the model for curriculum design developed in Interdepartmental 202, students plan a complete course in an area of individual selection.

Enrollment is subject to the approval of the instructors.

### **Interdepartmental 204c,d. Seminars on Educational Policy**

Seminars. *One 2-hour session each week; time to be arranged. 2 units. Additional credit may be arranged.* Dr. Segall.

Seminars are offered on policy issues related to training programs in community medicine and public health for specific categories of health manpower, including physicians, dentists, and allied health professionals in the United States, and health professionals in developing countries. Through individual instruction and seminar discussions, students will assess the impact of professional expectations, social needs, and institutional constraints on the selection of educational goals.

### **Interdepartmental 208a,b. Human Rights in Health**

Lectures. *One 2-hour session each week. 3 units.* Dr. Curran.

This course entails a comprehensive examination of human rights as they bear upon health programs, nationally and internationally. Among topics considered from ethical, cultural, and legal viewpoints are: rights to medical care and a healthy environment; equality; rights of medical patients, women, children, and experimental subjects; and problems of balancing personal rights and community protection.

### **Interdepartmental 209c,d. Health Services in Developing Countries**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Joseph, Dr. Wray, Miss Cohn.

This course centers on the following issues: analysis of the special health problems facing developing countries and of the organizational alternatives for utilizing health resources; the nature, composition, and training of the health team for use of the local and district levels; the relation of health to development and the position of health in national planning priorities.

### **Interdepartmental 210a,b. Economic Analysis for Public Health**

Lectures, discussions. *Two 1½-hour sessions each week. 4 units.* Dr. Berry.

This course provides an introduction to the basic principles of economics and economic analysis, particularly as they apply in the public health field. A systematic introduction to microeconomic theory includes the determinants of supply and demand, the theory of markets, and the concept of economic efficiency. In addition, attention is given to public expenditures and policy analysis.

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### **Interdepartmental 212c. Biomedical Writing**

Seminars. *One 2-hour session each week. 2 units.* Dr. Chernin.

Writing scientific papers is an integral part of the research process. This course develops practical skills and experience in planning and writing articles that meet the editorial demands of biomedical journals. The salient elements of a well-prepared article — logical organization, clear and concise scientific prose, and understandable tables and figures — are emphasized by criticizing short papers written by the participants on biomedical subjects of their own choice.

Enrollment is limited to 10 students, with advance approval of the instructor.

### **Interdepartmental 213a,b. Human Biology and Medicine**

Lectures, laboratories, demonstrations. *Three 2-hour sessions each week. 5 units.* Dr. Brain, Dr. Leith, Staff of the School of Public Health.

This course introduces the major principles of human physiology and general pathology. Students examine basic physiological processes which characterize human cells, organs, organ systems, and organisms as they respond to changing environments. Over half the course is identical to Physiology 203a,b. Sections at the beginning and end of the course will discuss aspects of general pathology, immunology, and infectious disease, as well as related issues such as strategies to reduce the impact of disease.

Prerequisites: Undergraduate courses in biology or physiology. Students lacking such a background should take Physiology 203a,b instead of Interdepartmental 213a,b.

A principal elective for students in the Health Policy and Management Program.

### **Interdepartmental 214a,b,c,d. Quantitative Analysis of Health Problems**

Seminars, lectures. *Two 1½-hour sessions each week; additional computational sessions to be arranged. 10 units.* Dr. Bishop, Dr. Thompson.

The purpose of the course is to provide students with (1) motivation to analyze health problems quantitatively, (2) understanding of a broad range of quantitative techniques and ideas, (3) technical competence in a selected few techniques, and (4) the critical capacity to evaluate realistically the power and limitations of quantitative analyses. Major topics include the theory of uncertainty and models of probabilistic systems, research design, data analysis, deterministic modeling, and optimization techniques.

Required for students in the Health Policy and Management Program. Enrollment of other students is subject to the approval of the instructors.

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### **Interdepartmental 215c,d. Environmental Health Evaluation and Management**

Seminars, lectures. *Two 1½-hour sessions each week; additional computational sessions to be arranged. 5 units.* Dr. Harrington.

This course introduces concepts and analytical methods for the quantitative evaluation and management of man's environment. Topics discussed include the development of natural resources, resulting environmental conditions, and effects on human health. Where appropriate, mathematical models are developed and critiqued in a systems analysis framework. Students are required to submit a term project.

A principal elective for students in the Health Policy and Management Program. A strong background in college-level mathematics is assumed.

### **Interdepartmental 216c,d. The Social Context of Medicine and Health in America (Social Sciences 114)**

Lectures, discussions. *Two 1½-hour sessions each week; additional 1-hour discussion session to be arranged for students at the School of Public Health. 5 units.* Dr. Rosenkrantz.

This course discusses the development of medical institutions and practice from colonial times to the present; the social and scientific origins of ideas about the nature and significance of disease; the emergence of the medical professions; the importance of homeopathy and botanism; the hospital as a refuge and a treatment center; supporting professions and institutions; medicine and social welfare; 19th-century bacteriology and 20th-century biomedical research.

This course or an accepted alternative is required for students in the Health Policy and Management Program.

### **Interdepartmental 300a,b,c,d. Teaching of Community Medicine and Public Health**

*Time and credit to be arranged.* Dr. Segall.

Interested students may elect tutorial work in curriculum design, development of methods of instruction and evaluation, and other areas related to teaching community medicine and public health.

## DEPARTMENT OF BEHAVIORAL SCIENCES\*

Robert J. Haggerty, A.B., M.D., Roger Irving Lee Professor of Public Health (Health Services and Pediatrics) and Acting Head of the Department

*Faculty:* Visiting Professor Mertens; Associate Professors R. Benfari, McAuliffe, J. Murphy, and Sheldon; Lecturer Wechsler

*Teaching and Research Staff:* Lecturers and Visiting Lecturers J. Barrett and Rolde; Research Associate Rasmussen

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The Department of Behavioral Sciences has a primary concern with the relationship of social and cultural factors to mental health and mental illness and the way social, cultural, and psychological factors affect the development and effectiveness of planned changes, particularly those involving public health programs.

Students have the opportunity to study psychiatric epidemiology, cross-cultural psychiatry, the characteristics of mental health services, and the role of cultural factors in health and disease. Considerable emphasis is given to research and research methodology.

The teaching plan is geared both to the student who has a social science background and wishes to know more about mental health and illness, and to the student who has a clinical orientation and wishes to know more about the social, cultural, and psychological influences which shape the human community. The Department participates in the programs leading to the degrees of Master and Doctor of Public Health and Master and Doctor of Science. (A description of programs leading to the degree of S.M. in Behavioral Sciences may be found in the section entitled "Admission and Degree Requirements and Academic Programs.")

### **Behavioral Sciences 202b. Advanced Topics in the Behavioral Sciences: Pathological Styles of Behavior**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Rolde.

This seminar presents a sociopsychological approach to abnormal psychology, and an eclectic examination of concepts in mental illness. The course examines the lifestyles that have led to the development of the concepts of psychosis, retardation, neurosis, and psychopathy.

The course is intended for students with a wide variety of backgrounds. It is designed to complement Behavioral Sciences 212a, and students may wish to take the two courses in sequence.

\*The Department of Behavioral Sciences is functioning for administrative purposes within the Department of Health Services (described later in this catalog).

**Behavioral Sciences 202c. Advanced Topics in the Behavioral Sciences: Social Processes**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Murphy.

This seminar deals with various ways of conceptualizing and measuring social processes of relevance to public health, with particular reference to mental health and mental illness. This includes studies of community integration, social class, and poverty. In addition, attention is given to the family, anomie, social networks, cultural values, and behavior settings. The course is designed especially for students who plan to work in fields such as social psychiatry, medical anthropology, or medical sociology.

Enrollment is subject to the approval of the instructor.

**Behavioral Sciences 202d. Advanced Topics in the Behavioral Sciences: Field Surveys in Psychiatric Epidemiology**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wechsler.

This course complements Behavioral Sciences 204c, and carries further the review of problems, concepts, and methods in psychiatric epidemiology. Emphasis is given to the assessment of mental health in total populations, regardless of the utilization of treatment services and institutions. The course is primarily for students interested in social psychiatry.

Prerequisite: Behavioral Sciences 204c or permission of the instructor.

**Behavioral Sciences 203a,b. Personality Assessment in Field Surveys**

Seminars. *One 2-hour session each week. 5 units.* Staff of the Department. Not given in 1976-77.

This course familiarizes the student with various data-gathering techniques, such as clinical interviews, structured questionnaires, peer judgments, and standardized observations used in studying mental health and illness in populations. One segment of the course deals with the conceptualization and measurement of positive adaptation; another deals with assessing mental health of children.

Enrollment is subject to the approval of the instructor.

**Behavioral Sciences 204c. Psychiatric Epidemiology: Problems, Concepts and Methods**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wechsler.

The aim of this course is to introduce students to the field of psychiatric epidemiology. Such major objectives as description, etiological investigation, and applications of epidemiological methods to service needs are reviewed. Emphasis is on major psychoses such as schizophrenia and on the use of data obtained from psychiatric treatment services and institutions.

Prerequisites: Epidemiology 201a, Biostatistics 101a,b, or permission of the instructor.



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### **Behavioral Sciences 206c,d. Mental Health in the Non-Western World**

Lectures, seminars. *One 2-hour session each week. 5 units.* Dr. Murphy.  
This course surveys mental and emotional problems in non-Western areas. Topics include cultural relativity in definitions, epidemiological findings, and the role of stress through cultural change, poverty, community disintegration, etc. Indigenous treatments and modern services for the mentally ill are discussed.

Enrollment is subject to the approval of the instructor.

### **Behavioral Sciences 208a,b. Sociology of Addiction**

Seminars, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. McAuliffe.

Through lectures and discussions, the course covers the following topics: epidemiology, diffusion of drug use among peer groups, public policy, strategies of treatment and prevention, drug effects on maternal and child health, program planning and administration, deviant careers of addicts, social control, and community responses to sociomedical problems.

### **Behavioral Sciences 210d. Inducing Social Change**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Mertens.

This course is designed for various specialists in public health who are charged with responsibility for introducing changes in organizations and communities. The subject matter includes methods and theories of teaching, principles of individual and group psychotherapy, approaches to sensitivity training and group dynamics, and organizational theory. Techniques and procedures illustrating these theories are presented through readings, discussions, and case illustrations.

### **Behavioral Sciences 211d. Psychiatric Problems in Organizations and Industry**

Lectures, readings, case illustrations. *One 2-hour session each week. 2.5 units.* Dr. Mertens.

The course is designed to provide basic information relevant to clinical and case management in industrial and other organizational settings. It analyzes research and clinical findings in such a way as to prepare students to handle not only individual maladaptation, but also disintegration at the organizational level. It presents successively etiology and symptomatology of individual and group dysfunction and is designed for students who already have a basic knowledge of psychopathology.

Enrollment is subject to the approval of the instructor.

### **Behavioral Sciences 212a. Antisocial Behavior**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Rolde.

The focus of this course is on individuals whose behavior is considered



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antisocial, immoral, or dangerous by the majority or controlling elements of society; examples of such behavior include violence, delinquency, addiction, psychopathy, unconventional sexuality, and so on. The emphasis of the course will be on positive approaches, the avoidance of stereotyping, and the comparison of differing perspectives.

The course is intended for students with a wide variety of backgrounds. It is designed to complement Behavioral Sciences 202b, and students may wish to take the two courses in sequence.

### **Behavioral Sciences 213a,b. Managing Human Resources in Primary Health Care Settings**

Lectures, discussions. *One 3-hour session each week. 5 units.* Dr. Benfari. Not given in 1976-77.

Drawing heavily upon the applied behavioral sciences, this course is designed to provide future planners and managers in primary health care settings with knowledge and skills in designing and structuring organizations; planning and goal setting in complex environments; clarifying and allocating role responsibilities; making effective decisions; improving the effectiveness of teams; managing interprofessional conflicts; and managing the process of change.

### **Behavioral Sciences 214c,d. Laboratory in Professional Relations in Organizational Settings: An Experiential Approach**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Benfari.

This course seeks to communicate some knowledge of group dynamics and organizational behavior as applied to situations health workers encounter. Group sessions are organized around professional issues, i.e., authority, professionalism, psychological competence, and system effectiveness versus efficiency. Seminars are designed to simulate interpersonal or organizational phenomena in a group setting. Students take on active roles in analyzing situations and developing patterns of behavior for more effective functioning.

Enrollment is limited and is subject to the approval of the instructor.

### **Behavioral Sciences 300a,b,c,d,e. Tutorial Programs**

*Time and credit to be arranged.* Staff of the Department.

Arrangements can be made for a reading course in selected topics or practical experience in research. Topics offered include "Anthropology and Public Health" ("d" period, Dr. Murphy) and "Social Interaction: Theory and Practice" (Dr. Rasmussen).

### **Behavioral Sciences 330e. Field Study**

A limited number of openings exist for research experience in the Department's field stations. These opportunities vary in nature from time to time

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according to the stages of various research projects. Individual arrangements can be made through the Head of the Department.

### **Behavioral Sciences 350. Research Training**

Training in research is available to doctoral candidates through individual arrangements with the staff of the Department. Topics offered include "Public Health Research in Community Settings" (Dr. Wechsler).

## DEPARTMENT OF BIOSTATISTICS

Jane Worcester, A.B., Dr. P.H., S.D. (hon.), Professor of Biostatistics and Head of the Department

*Faculty:* Professors J. Feldman, Miettinen, and Reed; Associate Professors Bishop, Drolette, and Frazier; Assistant Professors Kleinman, Laird, and Warram; Lecturer Jones

*Teaching and Research Staff:* Lecturers and Visiting Lecturers Gero, Kent, Neff, and Wyshak

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The teaching aims of the Department of Biostatistics may be divided very generally into three categories:

First, it is essential for workers in all branches of public health to be able to draw justified conclusions from numerical data and to base logical action on these conclusions. This applies to the administrator who must evaluate problems and the results of his activities, as well as to the epidemiologist and the research worker who must apply statistical techniques to their laboratory and field problems. The course Biostatistics 101a,b is therefore designed to give not only a minimum command of simple methodology to all students but an appreciation of the value of the method and an awareness of the frequent abuse encountered in the health literature.

Second, field and laboratory researchers must be able to use statistical methods in planning and analyzing their experiments and problems. Elective courses are designed to provide an introduction to methodology in this area. These courses are adapted to the needs of students of this School, many of whom have broad backgrounds in biological sciences while few have extensive preparation in mathematics. A minimum of mathematical exposition is therefore included in courses intended for students in these categories. Instead, the emphasis is on understanding the underlying assumptions inherent in standard statistical procedures and on the ability to determine when such procedures are appropriate.

Third, there is a smaller group of students particularly interested in graduate work in biostatistics. To meet the needs of these students, the Department offers programs leading to the degrees of Master and Doctor of Science in Biostatistics. A description of the Master of Science program and a general description of the doctoral programs offered by the School may be found in the section entitled "Admission and Degree Requirements and Academic Programs."

Any course in the Department is open to any student who meets the prerequisites stated in the course description.

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### **Biostatistics 101a,b. Principles of Biostatistics**

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 3.5 units.* Staff of the Department.

Lectures and laboratory exercises acquaint the student with demographic concepts, the nature and composition of rates, and their uses in administration and epidemiology. The theory of measurements and distributions including estimation and tests of significance are discussed. Basic concepts of probability and association, sampling techniques, and study design are introduced.

### **Biostatistics 202c,d. Statistical Methods in Research**

Lectures, discussions, laboratory. *Two 3-hour sessions each week. 5 units.* Dr. Worcester, Dr. Drolette, Dr. Warram.

This course, a continuation of Biostatistics 101a,b, introduces the student to technical statistical procedures important in problems of laboratory and field research. Topics included are further considerations of probability and regression, together with an introduction to procedures used in the planning of experiments, including variance analysis, nonparametric methods, dosage response, and regression.

Prerequisite: Basic preparation in statistics.

### **Epidemiology and Biostatistics 203b. Principles of Epidemiologic Research I: Problem Conceptualization and Study Design**

Lectures, seminars. *Two 2-hour lectures and one 1-hour seminar each week. 4 units.* Dr. Miettinen, Dr. Rothman.

(Course is described under Department of Epidemiology.)

### **Epidemiology and Biostatistics 203c. Principles of Epidemiologic Research II: Data Analysis and Inference**

Lectures, laboratory. *One 2-hour lecture and one 1-hour laboratory session each week. 3 units.* Dr. Miettinen, Dr. Rothman.

(Course is described under Department of Epidemiology.)

### **Epidemiology and Biostatistics 204c,d. Principles of Epidemiologic Research III: Applications**

Tutorials, seminars. *Tutorial sessions during third period; one 2-hour seminar each week during fourth period. 2.5 units.* Dr. Rothman, Dr. Miettinen.

(Course is described under Department of Epidemiology.)

### **Biostatistics 205c,d. Mathematical Foundations of Biostatistics**

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Drolette.

The material covered includes mathematical descriptions of commonly

used distributions, standard procedures for estimating the moments of a distribution, and mathematical foundations of statistical inference, including the Neyman-Pearson lemma, the likelihood ratio, the central limit theorem, power and Bayesian inference.

Prerequisite: A course in elementary calculus.

**Biostatistics 207c,d. Survey Research Methods in Community Health**

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Feldman.

Research design, sample selection, questionnaire construction, interviewing techniques, the reduction and interpretation of data, and related facets of population survey investigations are covered. The course is focused primarily on the application of survey methods to problems of health program planning and evaluation. The treatment of methodology is sufficiently broad to be suitable for students who are concerned with applications to epidemiological, nutritional, or other types of survey research.

**Biostatistics 210c,d. Advanced Topics in Biostatistics**

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Drolette.

Topics covered include principal components, classification and clustering, factor analysis, canonical correlation, regression and discrimination, with some discussion of distribution theory, models, and tests of hypotheses. Primary emphasis is on application and interpretation.

Prerequisites: At least one statistics course beyond Biostatistics 101a,b and a knowledge of matrices. Enrollment is subject to the approval of the instructor.

**Biostatistics 211c,d. Discrete Multivariate Analysis**

Lectures, discussions. *One 2-hour session each week. 5 units.* Dr. Bishop.

This course deals with the use of log-linear models for describing multidimensional contingency tables. Emphasis is on practical application rather than mathematical theory. Topics covered include use of such models for determining when tables can be reduced in size without changing the relationships between variables, hypothesis testing, obtaining rates standardized for more than one underlying variable, and combining data sets from different sources.

Prerequisite: A statistics course which includes analysis of variance.

**Biostatistics 213b. Computing Principles and Methods**

Lectures, discussions, laboratory. *Two 2-hour sessions each week. 2.5 units.* Dr. Drolette, Mr. Neff, Staff of the Health Sciences Computing Facility.

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Among the principles and methods of computing and data processing included in the course are programming, flow-charting, and use of program packages and libraries, particularly criteria for choosing among existing programs. Case studies are used to illustrate methods of data collection, coding, and data reduction.

Enrollment is subject to the approval of the instructor.

### **Biostatistics and Health Services Administration 216c,d. Health Program Evaluation**

Lectures, discussions. *One 2-hour session each week. 2 units each period. 216c may be taken without 216d.* Mr. Frazier, Dr. Feldman, Dr. Reed.

This course is designed to increase the student's ability to understand the uses and limitations of methods employed to evaluate health programs. The course provides an overview of the purposes and procedures of evaluation methods as applied to health programs. The course is sufficiently broad to be of interest to program administrators and to health program analysts.

### **Health Services Administration and Biostatistics 290d. Analysis of Health and Medical Practices (Public Policy 290)**

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Milton C. Weinstein (Associate Professor of Public Policy, John F. Kennedy School of Government).

Not given in 1976-77.

(Course is described under Department of Health Services.)

### **Biostatistics 310-315a,b,c,d. Tutorial Programs**

*Time and credit to be arranged.* Staff of the Department.

An opportunity for tutorial work at the master's level is offered for interested and qualified students or small groups of students. Arrangements must be made with individual faculty members and are limited by the amount of faculty time available. These tutorial programs are open to students specializing in biostatistics and also to students in other fields who wish to go beyond the content of the regular courses. Six broad categories of this tutorial instruction are identified by the six course numbers below.

#### **310 *Tutorial in Statistical Methods***

Guided study in specific areas of statistical methodology and application.

#### **311 *Tutorial in Teaching***

Work with the Department in laboratory instruction and the development of teaching materials.



- 312 *Tutorial in Consultation*  
Work with members of the Department on current statistical consultation activities.
- 313 *Tutorial in Computing*  
Guided study in scientific programming, numerical methods, and data management.
- 314 *Tutorial in Study Design*  
Guidance in developing statistical design of a study in which the student has a particular interest.
- 315 *Tutorial in Data Analysis*  
Guidance in the statistical analysis of a body of data in which the student is interested.

Students may register for Biostatistics 310-315 for a maximum of ten credit units in the summer term.

**Biostatistics 350. Research**

Candidates for the Doctor of Public Health, Doctor of Science, or other doctoral degrees may arrange for individual research. The work may be part of the program for a doctorate in this Department or may be integrated with doctoral research in other departments.

## **ENVIRONMENTAL HEALTH INTERDEPARTMENTAL COURSES**

The following courses are conducted by the faculty and staff of the Kresge Center for Environmental Health, which includes the Departments of Environmental Health Sciences, Physiology, and Sanitary Engineering.

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### **Environmental Health Interdepartmental 201a,201b. Principles of Environmental Health**

Lectures, discussions. *Two 1-hour sessions and one 2-hour session each week. 2.5 units each period.* Dr. Moeller, Staff of the Kresge Center.

This course reviews the more important environmental health problems facing society today. Topics covered in the "a" period include environmental radiation control, community air pollution, occupational health, and selected physical stresses. Topics covered in the "b" period include basic sanitation, water purification, traumatic injuries, environmental law and economics, environmental toxicology, land use planning, and the environmental health implications of energy use. Either period may be taken separately.

### **Environmental Health Interdepartmental 202c,d. Community Environmental Health Management — A Computerized Game**

Lectures, discussions, role playing. *One 1-hour and one 3-hour session each week. 5 units.* Dr. Moeller, Dr. Spengler, Staff of the School of Public Health.

This is a computerized game which simulates a metropolitan environment by including basic data on such factors as air pollution characteristics, employment, land use, and public services. By playing such roles as air pollution control officers, politicians, town planners, industrialists, and land developers, students are given the opportunity to make decisions on issues raised by the community.

Enrollment is limited to 60 students.

### **Environmental Health Interdepartmental 203a,b,c,d. Principles of Aerospace Health and Safety**

Seminars. *One 2-hour session each week. 5 units.* Dr. \_\_\_\_\_.  
Not given in 1976-77.

Principles of aerospace medicine are presented as they affect health and performance of individuals exposed to physical, chemical, and biological stress. Established associations between environmental stress and harmful effects are compared to accepted safe limits for human tolerance.

Prerequisite: Physiology 203a,b or equivalent. Enrollment is subject to the approval of the instructor.

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### **Environmental Health Interdepartmental 204c,d. Human Factors in Occupational Performance and Safety**

Lectures, demonstrations. *One 2-hour session each week. 2 units.* Dr. Snook.

This course emphasizes the design of the job to fit the worker. Specific problems are investigated which result from the nature of the job itself, e.g., low back injuries, fatigue, hand disorders, slips and falls, human error, and psychological stress. The physiological, psychological, and anatomical characteristics of the worker are considered in the development of good job design principles.

### **Environmental Health Interdepartmental 206c,d. Occupational Medical Clinics**

Clinics. *One 2-hour session each week. 2 units.* Dr. Peters, Dr. Murphy. These clinics are concerned with occupational diseases, such as silicosis, beryllium intoxication, coal miner's pneumoconiosis, and lead poisoning. Special clinics are held in ophthalmology and dermatology.

The clinics are limited to physicians and are not offered if less than 4 students enroll.

### **Environmental Health Interdepartmental 207c,d. Policy Issues in Occupational Health**

Lectures, seminars. *One 2-hour session each week, third period; two 2-hour sessions each week, fourth period. 3 units.* Dr. Peters, Dr. Wegman, Mr. Boden.

This course considers roles of different agencies and institutions in achieving a healthful workplace, including government, corporations, unions, and research organizations. Representatives of each will present their views. The political, economic, and legal foundations of the actors and their interactions are highlighted. The nonscientific uses of scientific information will be explored.

### **Environmental Health Interdepartmental 209c,d. Mathematical Modeling for Health Sciences**

Lectures, discussions. *Three 1-hour sessions each week, third period; two 2-hour sessions each week, fourth period. 4 units.* Dr. Dawson.

A range of models for the space and time dependence of the key variables in natural systems is discussed. Specific applications emphasize processes that characterize the response of the organism to its environment. The inverse problem of using measurements to infer estimates of parameters of models is developed.

Prerequisites: Calculus, Physiology 203a,b, and statistics to the level of concurrent enrollment in Biostatistics 202c,d, 205c,d, or 210c,d.

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### **Environmental Health Interdepartmental 330e. Field Work**

*One-week period between fall and spring terms. 1 unit.*

A week of supervised field observation is offered during the one-week period between fall and spring terms. Students may choose appropriate visits to medical or industrial hygiene departments of industries, airports, and other agencies which have operations or research in the field of environmental health.

## DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCES

Dade W. Moeller, S.B., S.M., Ph.D., A.M. (hon.), Professor of Engineering in Environmental Health, Head of the Department, and Associate Director, Kresge Center for Environmental Health

*Faculty:* Professor First; Associate Professors Burgess and Dennis; Assistant Professors Cooper, Hinds, D. H. Leith, Spengler, and Underhill; Lecturers Bjarngard, Cudworth, Shapiro, and Webster

*Teaching and Research Staff:* Lecturers and Visiting Lecturers Anderson, J. M. Austin, Billings, Dane, Mahoney, Naegele, Nelson, O'Connor, Schulte, Svensson, Viles, and Zimmerman; Research Associates Grubner and Wolfson

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Because of growing public awareness of the need for environmental pollution control and worker protection, increasing attention is being focused on these problems at all levels of our society. Research and training have been conducted on these major subjects at the Harvard School of Public Health since 1918. Applicable curricula offered by the Department of Environmental Health Sciences include air pollution control, environmental health management, industrial hygiene, medical radiological physics, and radiological health. In addition to specialized courses, graduate education in each of these fields includes courses on human physiology, epidemiology, and biostatistics. Programs of the Department are open to engineers, physicians, and other professional personnel with undergraduate backgrounds in physics, chemistry, mathematics, and biology. (For a description of the Master of Science programs offered by the Department, see the section entitled "Admission and Degree Requirements and Academic Programs.")

Supporting the teaching program are extensive research activities. Current studies include an evaluation of performance factors for respirators and gas masks, assessment of the environmental impact of nuclear facilities, medical radiation applications and dosimetry, the design of cleanup systems for radioactive sodium aerosols, the application of gas- and liquid-phase reactions to particulate and gas removal, a numerical study of urban scale atmospheric transport, the monitoring of worker stresses by telemetered physiological measurements, and an investigation of the population dose from radiation of natural origin. Supporting these studies are related cooperative research projects conducted by the Departments of Physiology and Epidemiology. As a result, students have many excellent opportunities for research, either on an independent basis or as a participant in an ongoing project.

As may be noted, some of the courses in this Department carry "Engineering" numbers. These are cross-listed in the catalog of the Division of Engineering and Applied Physics in Cambridge and provide course credit through that Division as well as through the School of Public Health.

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### **Environmental Health Sciences 202b. Departmental Seminar**

Seminars. *One 2-hour session each week. 1 unit.* Staff of the Department. The purpose of these seminars is to supplement the formal course work of the Department by bringing to the attention of students a wide range of topics of contemporary interest in air pollution control, industrial hygiene, and radiological health. Discussion leaders include faculty members from the Kresge Center, students from the Department, and specialists from industrial, governmental, and university research centers.

### **Environmental Health Sciences 251c,d. Basic Problems in Occupational Health and Industrial Environments (Engineering 282)**

Lectures. *Two 2-hour sessions each week.*

Laboratory demonstrations, field trips. *One 3-hour session each week. 5 units.* Dr. Ferris, Dr. First, Dr. Peters, Mr. Burgess.

Lectures, laboratory demonstrations, and inspections of workplaces show the relation of working conditions to health, with special reference to the recognition, measurement, and control of hazards. Examples include adverse conditions of temperature, humidity, radiation, and chemical and physical irritants. Particular emphasis is given to the prevention, diagnosis, and treatment of industrial disability and disease, and to workmen's compensation.

Prerequisite: Physiology 203a,b.

### **Environmental Health Sciences 252c, 252d. Environmental Control (Engineering 280)**

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 2.5 units each period.* Mr. Burgess, Dr. Cudworth.

The first half of this course centers on the design and evaluation of industrial ventilation systems for the control of toxic contaminants released into the workplace through industrial operations and processes. The second half is designed for environmental health specialists responsible for evaluation and control of noise hazards. Topics include measurements and instrumentation, and specific control approaches for production equipment.

### **Environmental Health Sciences 253a,b. Aerosol Technology (Engineering 286)**

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 2-hour session each week, first period; one 4-hour session each week, second period. 5 units.* Dr. Hinds.

This course covers the properties of suspended particulate matter (dust, smoke, clouds) and the physical principles underlying its behavior. Topics covered include: particle motion due to gravitational, thermal, and elec-



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trostatic forces; diffusion; impaction; coagulation; filtration; condensation and evaporation; optical properties; and sizing statistics. Laboratories cover optical and electron microscopy, sampling, and mass concentration and particle size measurement.

### **Environmental Health Sciences 261a,b. Community Air Pollution\***

Lectures, demonstrations, seminars. *One 2-hour session each week. 2.5 units.* Dr. First, Staff of the Kresge Center.

This course is designed for engineers, chemists, and physicians interested in air pollution control. Topics presented include the measurement and control of community air pollution; air quality standards; health effects of air pollution; damage to animals, plants, and property; community and site surveys; the legal and enforcement aspects of air pollution control; and the nature and quantity of atmospheric emissions from transportation vehicles, municipal incinerators, and specific industries.

### **Environmental Health Sciences 262a,b. Meteorological Aspects of Air Pollution\***

Lectures, demonstrations. *One 2-hour session each week. 2.5 units.* Dr. Spengler.

This course presents an evaluation of the meteorological factors associated with the transport of air pollutants. Topics include properties of the atmosphere near the ground, turbulent dispersion of air pollutants, atmospheric diffusion equations, diffusion from single and area sources, mathematical models for evaluating urban air pollution, and instrumentation for evaluating the movement and behavior of air pollutants.

### **Environmental Health Sciences 264c,d. Identification and Measurement of Air Contaminants (Engineering 283)**

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Underhill, Staff of the Department.

This course emphasizes sampling and analytical methods for air contaminants plus related subjects. Included are chemical and instrumental methods of air analysis, isokinetic sampling, biological and solvent analysis, radioactive aerosol determinations, air pollution surveys, and fire and explosion evaluations. The course is recommended for students concentrating in industrial hygiene and air pollution control and suggested for students in the radiological health and the Master of Industrial Health programs.

\*These two courses constitute Engineering 284.

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### **Environmental Health Sciences 265c,d. Air and Gas Cleaning**

Lectures. *One 2-hour session each week.*

Laboratory. *One 2-hour session each week. 5 units.* Dr. First, Dr. Leith, Staff of the Department.

This course covers theory, selection, application, and testing of air and gas cleaning devices, including gas absorption in liquids and adsorption on solids, gas incineration, particle collection by inertial and centrifugal force, and basic processes of particle conditioning. Laboratory experiments and case studies illustrate important aspects of sizing and correct selection of equipment.

Prerequisites: Environmental Health Sciences 253a,b and 264c,d (may be taken simultaneously).

### **Environmental Health Sciences 271a,b. Introduction to Radiation Protection (Engineering 288)**

Lectures. *Two 1-hour sessions each week.*

Laboratory, field trips. *One 3-hour session each week. 5 units.* Dr. Shapiro.

This course presents the elements of radioactivity; interaction of radiation with matter; methods for radiation protection; radiation protection standards; and the major sources of population exposure. Work includes assigned readings on radiation protection guides and the public health implications of radiation uses. Laboratory exercises provide an introduction to measurement and safe use of radiation sources.

### **Environmental Health Sciences 272a,b. Radiation Protection Engineering (Engineering 287)**

Lectures. *Two 2-hour sessions each week. 5 units.* Dr. Shapiro.

This course covers the basic physical principles, mathematical analyses, and engineering methods utilized in the evaluation and control of radiation hazards. The material is developed through consideration of radiation protection problems of nuclear power reactors, radiation-producing machines, and radiochemical laboratories. Topics covered include: neutron slowing and diffusion; nuclear reactor theory; criticality safeguards; radiation shielding; in-plant radiation protection; and analysis of environmental hazards.

Enrollment is subject to the approval of the instructor.

### **Environmental Health Sciences 273c,d. Problems in Radiation Dosimetry**

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 4 units.* Dr. Shapiro.

This course deals with the experimental and theoretical methods of evaluating radiation fields and determining radiation dose rates. Special

dosimetry problems for study in the laboratory are selected from the fields of health physics, nuclear engineering, and nuclear medicine.

Prerequisite: Environmental Health Sciences 271a,b.

#### **Environmental Health Sciences 274c. X-ray Protection**

Lectures. *One 2-hour and one 1-hour session each week.*

Laboratory. *One 3-hour session each week. Time to be arranged. 2.5 units.*

Dr. Webster.

This course covers the fundamentals of X-ray equipment (both industrial and medical), the design of X-ray installations, and procedures for radiation protection surveys and inspections, and includes several problem assignments. Considerations include both equipment and room design, with emphasis on items such as leakage, collimation, filtration, primary and secondary barriers, workload, and protection of patients.

Prerequisite: Environmental Health Sciences 271a,b.

#### **Environmental Health Sciences 281a. Introduction to Physics of Diagnostic Radiology.**

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Bjarngard, Dr. Philip Judy (Instructor in Radiology, Harvard Medical School).

Given alternate years; to be given in 1977-78.

This course for students in medical physics and radiological health covers the fundamentals of diagnostic radiology, including diagnostic criteria, such as abnormal size, position, motion, or structure; principles of specific studies, e.g., mammography and cardiac angiography; and the use of contrast media. The course also reviews principles of equipment employed, such as diagnostic X-ray sources, recording systems, film, screens and image intensifiers, and factors affecting image quality and patient exposure.

#### **Environmental Health Sciences 282b. Introduction to Physics of Nuclear Medicine**

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Bjarngard, Mr. Zimmerman.

Given alternate years; to be given in 1977-78.

Production and properties of radionuclides and radiopharmaceuticals, as well as the physiological basis for medical applications, form the foundation for this course for students in medical physics and radiological health. Principles of specific studies are presented (e.g., uptake measurements, tracer kinetics, static and dynamic imaging and *in vitro* techniques). Instrumentation and factors affecting accuracy, image quality, and patient exposure are also discussed.

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### **Environmental Health Sciences 283a. Introduction to Physics of Radiation Therapy**

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Svensson.

Given alternate years; to be given in 1976-77.

This course for students in medical physics reviews tumors of different primary sites, including their histology and routes of spread. Various aspects of radiation therapy are discussed, including time-dose relationships, influence of oxygen and chemical agents, tumor localization, treatment planning, and simulation. Also covered are treatment with external beams, radioactive isotopes, implants and intercavitary sources; dose calculations; and machine design and specifications.

### **Environmental Health Sciences 284c,d. Physics of Diagnostic Radiology**

Lectures. *One 2-hour and one 1-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Webster.

Given alternate years; to be given in 1977-78.

This course deals with the physical and mathematical aspects of image formation, including characteristics of diagnostic X-ray machines and recording systems, geometrical relationships, X-ray spectra, information limits, optical physiology and performance, special techniques such as magnification and cine radiography, and computerized tomography. Radiation protection is also covered, with an emphasis on patient dose.

### **Environmental Health Sciences 285a,b. Physics of Nuclear Medicine**

Lectures. *One 2-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Bjarngard, Mr. Zimmerman.

Given alternate years; to be given in 1976-77.

The emphasis of this course is on the physical and chemical aspects of production, properties and standardization of radionuclides and radiopharmaceuticals, including cyclotron production of short-lived isotopes. Also covered are instrumentation (e.g., scanners, cameras, proportional counters, and the positron camera) and computer applications involving dynamic and regional function analysis, radionuclide tomography, and image processing. The measurement of calcium content of bone is also discussed.

### **Environmental Health Sciences 286c,d. Physics of Radiation Therapy**

Lectures. *One 2-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Bjarngard.

Given alternate years; to be given in 1976-77.

This course deals with the mathematics of treatment planning for external beams, brachytherapy and radioactive nuclides, including computerized techniques. Also covered are accurate and precise dosimetry mea-

## ENVIRONMENTAL HEALTH SCIENCES

measurements for photons, electrons, protons, and neutrons, including calibration and quality control of machines and sources. Selected studies of current clinical problems are also presented.

### Environmental Health Sciences 301-306a,b,c,d,e. Tutorial Programs

Reading or research. *Time and credit to be arranged.*

Reading or research assignments for individual tutorial work at a master's degree level are provided for qualified students in the fields of industrial hygiene, industrial ventilation, aerosol technology, radiological health, medical radiation physics, nuclear medicine, solid waste management, air pollution control, and environmental health management.

- 301 *Air Pollution.* Dr. Cooper, Dr. First, Dr. Leith, Dr. Spengler, Dr. Underhill.
- 302 *Industrial Hygiene.* Mr. Burgess, Dr. Hinds.
- 303 *Radiological Health.* Dr. Moeller, Dr. Shapiro.
- 304 *Medical Physics.* Dr. Bjarngard, Dr. Webster.
- 305 *Solid Wastes.* Dr. First.
- 306 *Environmental Health Management.* Dr. Cooper, Dr. Moeller.

Enrollment is subject to the approval of the Head of the Department.

### Environmental Health Sciences 350-360. Research

Facilities of the Department are available for doctoral candidates and properly qualified second-year master's degree students to pursue independent research on problems in industrial hygiene, aerosol technology, solid waste management, air pollution control, and radiological health. Areas currently receiving study in the Department are as follows:

- 351 Evaluation of performance factors of respiratory protective devices; monitoring exposures of occupational groups to toxic air contaminants; ventilation control of airborne contaminants; evaluation and control of noise (*Mr. Burgess*).
- 352 Application of gas- and liquid-phase reactions to particulate and gas removal; development and design of cleanup systems for airborne contaminants from industrial and nuclear power plant facilities; incineration of solid wastes including municipal, radioactive, biological, and laboratory materials (*Dr. First, Dr. Leith*).
- 353 Measuring and modeling the performance of industrial gas cleaning equipment; assessing the air pollution potential of simple and complex pollution sources (*Dr. Leith*).
- 354 Computer modeling of pollutant transport in urban atmospheres; analysis of air quality data derived from sampling networks; meteorology of urban areas (*Dr. Spengler*).



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- 355 Experimental and theoretical research in aerosol generation, measurement, and behavior, with emphasis on the measurement and control of particulate air pollutants (*Dr. Cooper*).
- 356 Reduction of population dose from sources of natural origin; environmental protection for nuclear facilities; radiation safety criteria and standards (*Dr. Moeller*).
- 357 Sampling and analysis of aerosol particles both in the ambient atmosphere and under laboratory conditions; generation of monodisperse aerosols; uses of aerosols in environmental health; development of particulate removal equipment (*Dr. Hinds*).
- 358 Evaluation and control of hazards from radioactive contamination; radiation dosimetry (*Dr. Shapiro*).
- 359 Medical radiation physics with emphasis on dosimetry, nuclear medicine, and radiation therapy (*Dr. Bjarngard*).
- 360 Medical radiation physics with emphasis on survey techniques, instrumentation, and image quality and patient dose reduction in diagnostic radiology (*Dr. Webster*).

Enrollment is subject to the approval of the Head of the Department.

## DEPARTMENT OF EPIDEMIOLOGY

Brian MacMahon, M.B., Ch.B., D.P.H., Ph.D., S.M. in Hyg., M.D., Professor of Epidemiology and Head of the Department

*Faculty:* Professors Hutchison, Miettinen, and Worcester; Associate Professors Cole, Monson, Rothman, and Segall; Visiting Associate Professor Pometta; Assistant Professors Dodds, Morrison, and Neutra

*Teaching and Research Staff:* Lecturers and Visiting Lecturers Jick, Miller, Paffenbarger, Sartwell, and Wyshak; Research Associates Finkle and Yen

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The major objective of the Department of Epidemiology is to provide opportunities for training and experience in the application of epidemiologic research methods to the investigation of diseases of unknown etiology. Emphasis is on the cardiovascular and mental disorders, the malignant neoplasms, abnormalities of reproduction and development, and other major diseases for which preventive measures are still unknown or inadequate.

One- and two-year research training programs lead to the degree of Master of Science in Epidemiology. (For a description of these programs, see the section entitled "Admission and Degree Requirements and Academic Programs.") For qualified students the period of research training may be extended by admission to either of the doctoral programs offered by the School, by admission to special student status, or through other individual arrangements. Most of the training period beyond the master's degree is occupied in supervised research experience. Potential doctoral candidates must plan at least two years in residence beyond completion of the master's degree.

A three-year residency in the Department of Epidemiology has been approved as satisfying residency requirements of the American Board of Preventive Medicine for certification in General Preventive Medicine. Requirements of the approved residency and of the School's degree programs may be satisfied simultaneously.

### **Epidemiology 201a. Principles of Epidemiology**

Lectures, seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Monson, Dr. MacMahon.

This course consists of lectures and seminars on the purposes, principles, and methods of epidemiology, defined as the study of the distribution and determinants of disease frequency in man. The principles discussed serve as an introduction to many aspects of the prevention and control of disease in populations. Illustrations include classic and contemporary studies of acute and chronic disease.

### **Epidemiology 202b. Epidemiology Seminars**

Seminars. *One 2-hour session each week. 1 unit.* Dr. Morrison, Staff of the Department.

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This course is intended as an extension of Epidemiology 201a. Principles and methods presented in 201a are considered in the context of substantive issues. Seminar groups will be formed on the basis of areas of interest to enrolled students. Each student will make one or more presentations, based on a study design or a review of one or more papers in a substantive area.

Prerequisites: Epidemiology 201a and Biostatistics 101a. Enrollment is limited and is subject to the approval of the instructor.

### **Epidemiology and Biostatistics 203b. Principles of Epidemiologic Research I: Problem Conceptualization and Study Design**

Lectures, seminars. *Two 2-hour lectures and one 1-hour seminar each week. 4 units.* Dr. Miettinen, Dr. Rothman.

With a detailed text in the background, the course utilizes simple examples and other illustrations to introduce the objects of epidemiologic research and the goals, options, and decision principles in study design. (A parallel tutorial course is available for those desiring in-depth study.)

Prerequisite: Epidemiology 201a.

### **Epidemiology and Biostatistics 203c. Principles of Epidemiologic Research II: Data Analysis and Inference**

Lectures, laboratory. *One 2-hour lecture and one 1-hour laboratory session each week. 3 units.* Dr. Miettinen, Dr. Rothman.

Again with a detailed text in the background, the course exploits examples from actual studies to introduce the principles of hypothesis testing and estimation in epidemiologic research. (A parallel tutorial course is available for those desiring in-depth study.)

Prerequisite: Biostatistics 101a,b.

### **Epidemiology and Biostatistics 204c,d. Principles of Epidemiologic Research III: Applications**

Tutorials, seminars. *Tutorial sessions during third period; one 2-hour seminar each week during fourth period. 2.5 units.* Dr. Rothman, Dr. Miettinen.

The seminars consist of student presentations of plans for and analyses of epidemiologic data, with discussion by students and faculty. Preparatory work is done under tutorial arrangements with members of the faculty. For the analyses, the emphasis will be on conceptual issues and not on execution.

Prerequisites: Epidemiology and Biostatistics 203b or Epidemiology 206b.

**Epidemiology 205c,d. Topics in Epidemiologic Research**

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Hutchison, Staff of the Department.

This course is intended for students who expect to conduct epidemiologic research. It consists of lectures on topics that are not part of the basic methodology covered in other courses in the Department. Topics include sampling, factors affecting response, data handling, analysis of time-place clustering, cyclic variation, survival, and problems of distinguishing genetic and environmental components of a disease.

Prerequisites: Epidemiology 201a and Biostatistics 101a,b, or equivalent.

**Epidemiology 206b. Epidemiologic Methods.**

Lectures. *Two 2-hour lectures each week. 2.5 units.* Dr. Cole, Staff of the Department.

This course is intended for students at the master's level who wish to acquire a familiarity with procedural and quantitative aspects of epidemiology. Study and program design will be presented, as will methods of analysis and interpretation. Effort will be made to emphasize concepts of practical value.

Prerequisite: Epidemiology 201a or equivalent.

**Epidemiology 211c,d. Epidemiology of Chronic Disease**

Lectures. *Each module requires one 2-hour session each week for one period. 1.25 units per module; 5 units if all modules elected.* Dr. Hutchison, Staff of the Department.

This course is a review of the epidemiology of chronic disease. It consists of four modules, any number of which may be elected. Two modules run in each period. The modules in the third period are: (1) cardiovascular and respiratory disease (Dr. Hutchison) and (2) cancer and screening (Dr. Cole). Those in the fourth period are: (3) diseases of the nervous and endocrine systems (Dr. MacMahon) and (4) effects of environmental exposures (Dr. Monson).

**Epidemiology 213d. Epidemiology of Oral Diseases**

Seminars. *One 2-hour session each week. 1 unit.* Dr. Rothman.

Given alternate years; to be given in 1977-78.

This course is intended for dentists with an interest in dental epidemiology, including surveys and clinical trials. The epidemiology of oral diseases is reviewed, and methodologic problems intrinsic to dental research are discussed. Participants are invited, but not required, to present an original study design for critical review. Topics to be covered include

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dental caries, periodontal diseases, oral cancer, malocclusion, and indices of oral health.

Enrollment is subject to the approval of the instructor.

### **Epidemiology 300a,b,c,d,e. Tutorial Programs**

*Time and credit to be arranged.*

Students may participate in departmental research in close association with a staff member. Time and credit are to be arranged with the Head of the Department.

### **Epidemiology 350. Research**

In selecting topics for research in doctoral programs, students should consider the fields in which members of the Department are currently working. These include:

Neoplastic disease (*Dr. MacMahon, Dr. Cole, Dr. Hutchison, Dr. Monson, Dr. Morrison*).

Congenital malformation (*Dr. MacMahon, Dr. Miettinen, Dr. Rothman, Dr. Yen*).

Cardiovascular disease (*Dr. Rothman, Dr. Miettinen*).

Effects of contraceptive agents (*Dr. Cole, Dr. Rothman*).

Environmental epidemiology (*Dr. Monson*).

Statistical methods (*Dr. Miettinen*).



## DEPARTMENT OF HEALTH SERVICES

Robert J. Haggerty, A.B., M.D., Roger Irving Lee Professor of Public Health (Health Services and Pediatrics) and Head of the Department

*Faculty:* Professors and Visiting Professors Berry, Curran, Densen, Reed, Roberts, Wray, Yerby, and M. Young; Associate Professors Hsiao, Nesson, Neuhauser, and Valadian; Assistant Professors P. Feldman, Fineberg, Thompson, and Wilson; Lecturers Braun, Dwyer, Joseph, Kasten, Sherman, Strong, Trevelyan, and Yacovone

*Teaching and Research Staff:* Lecturers and Visiting Lecturers Allen, Alpert, Andrews, Atamian, Bander, Berarducci, Boland, Cannon, Cohn, Coombs, Cotton, Crowdis, Dolinsky, Dooley, Dull, Earls, Entmacher, Levin-Epstein, Field, Fox, Guillozet, Haase, Hassan, Hemenway, Hilliard, Hobart, Hunter, Irish, Kelly, Komaroff, Kovar, LaCasse, Lesser, Levine, Liljestrand, Lion, Lorch, Martikainen, Medina, Messenger, Moore, Morgan, Morris, Neave, Newberger, Rockoff, Rosenberg, Ryan, Silberman, Storm, Taylor, Waters, Wathne, Weiner, White, and Yankauer; Instructors D. Barrett, Berwick, Dumbaugh, Palmer, and D. Young; Research Associates R. Butler and Winsten; Consultants Janeway and Livernash

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The goal of the Department of Health Services is to improve health care through education of future leaders in health services and through programs of research in developing and evaluating new community health systems. The Department offers two major areas of program specialization — health services administration and maternal and child health. These two areas represent the two departments which were combined to create the current Department of Health Services. A third department, the Department of Behavioral Sciences, is functioning for administrative purposes within the Department of Health Services; specialized programs are also offered in this area. Courses in the areas of health services administration and maternal and child health are described below; courses in the area of behavioral sciences are described under "Department of Behavioral Sciences."

Although students may concentrate in any one of these areas, the emphasis of the Department is upon the holistic nature of health services, including mental health services and services for special groups such as the handicapped, mothers and children, and the aged. The many disciplines relevant to health services are represented in the faculty — medicine, economics, law, political science, anthropology, psychology, sociology, public and business administration, and health education. Since the development of health policy, management of health systems, and development and evaluation of health services involve many academic disciplines, students may take courses in other parts of the University, such as the Medical School and schools on the Cambridge campus, to augment courses at the School of Public Health.

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In addition to the programs offered in the three areas listed above, the Program in Health Policy and Management (described on page 42), as well as the Executive Programs in Health Policy and Management (described on page 19), are integrated with the Department of Health Services through faculty appointments. The former is an interdisciplinary two-year program which leads to the degree of Master of Science. It is based on core courses listed under "Interdepartmental Courses" and under "Division of Health Services Administration" (of the Department of Health Services). In addition to these and other courses offered by the School of Public Health, students may select appropriate courses offered by other faculties at Harvard and by the Massachusetts Institute of Technology. The Executive Programs in Health Policy and Management offers a series of nondegree programs designed to provide continuing education in health management, policy, planning, and regulation for executives involved in health care.

### **Division of Health Services Administration**

The increasing complexity of medical services calls for diverse types of health organizations. The growth of organized health services has created an increased need for qualified administrators and researchers. A major goal of the division of health services administration is to provide education for leadership in health service organizations. Emphasis is placed on planning, organization, evaluation, and regulation of health services.

Special attention is given to macroadministration or the administration of health systems. Cross-national studies of health care systems are used as analytic tools to assist the student in gaining an appreciation of the universal nature of the determinants that govern organized activity for the delivery of health services.

Consideration is given to traditional administrative techniques as well as more recently developed quantitative and analytic methods. Since many problems, broad in scope, must be studied, the resources of multiple disciplines and several Harvard faculties are carefully integrated into the program.

The division participates in programs leading to the degrees of Master and Doctor of Public Health and Master and Doctor of Science. (For a description of the one-year program leading to the degree of S.M. in Health Services Administration, see the section entitled "Admission and Degree Requirements and Academic Programs." A two-year interdisciplinary program leading to the degree of S.M. in Health Policy and Management is also offered, and is described in that same section.)

Approved residency training is possible, leading to certification by the American Board of Preventive Medicine in the area of General Preventive Medicine (Health Services Administration). Requirements of the residency and of the School's degree programs may be satisfied simultaneously.

**Health Services Administration 201c. The Ecology, Nature, and Function of Health Service Systems**

Seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Yerby.

This course consists of analyses of environmental and intrinsic determinants of health service systems in selected developed and developing nations. The focus is on the explanatory value of historical, cultural, economic, political, technological, and other factors in understanding the structure and function of health systems. A case analysis method is employed. Case material and supplemental reading lists are provided.

Enrollment is limited to 30 students.

**Health Services Administration 202b,c,d. Seminar in Health Services**

Seminars. *One 2-hour session each week. 3 units (1 unit each period).* Dr. Haggerty, Staff of the Division.

This course is for persons concentrating in the Department of Health Services. It will be focused on current issues in health services.

**Health Services Administration 203a,203b,203c,203d. Administration and Organization of Health Services**

Lectures, discussions. *Two 1½-hour sessions each week. 1.5 units each period. Additional credit of 1 unit each period may be arranged.* Dr. Neuhauser, Dr. Benfari.

The "c" and "d" periods will not be given in 1976-77.

This course describes the character and function of the managerial process in health organizations. The "a" period focuses on organizational behavior and administration, the "b" period on cost control and operations research, the "c" period on cost-effective clinical decision making, and the "d" period on selected topics in health administration.

**Health Services Administration 204a. Social Welfare and Its Relationship to Health and Health Services**

Seminars. *One 2-hour session each week. 1 unit.* Dr. Yerby.

This course reviews the evolution of the concepts of social welfare in England and in the United States. Contemporary social welfare policies in the United States and in other nations are examined. The complementary relationship between health and social services is analyzed.

Enrollment is limited to 30 students.

**Health Services Administration 205a,b; 205c,d. Health Education**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Young, Staff of the Division.

This course is designed primarily for program administrators and emphasizes major aspects of learning theory, communication theory, educa-

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tional methods, and health behavior; health education in the process of social change; psychosocial and cultural factors relevant to planning of health education programs; and research and evaluation in health education.

The course is repeated in the third and fourth periods.

### **Health Services Administration 206c,d. Health Law, Public Policy, and Consumer Protection in the Health Field**

Seminars. *One 2-hour session each week. 2 units.* Dr. Curran.

This course covers the application of law and legislative process to the establishment of public policy in health fields such as medical care delivery systems, health manpower, and consumer protection. Special attention is given to regulation of quality in health care, consumer involvement, and equality of access to health systems. A case analysis method is employed.

### **Health Services Administration 207a,b. Dental Public Health Practice**

Seminars, field visits. *One 2-hour session each week. 2 units.* Dr. Yacovone.

This seminar provides in-depth training in the administration and planning of dental health programs. Subjects covered include community needs, resources, surveying, fluoridation, prepayment, and program evaluation. Each student develops a program plan in a specific area of community dental needs and presents the plan to the class.

### **Population Sciences and Health Services Administration 207c,d. Design and Management of Population Programs**

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. D. Korten, Dr. F. Korten, Dr. Wyon, Staff of the Department of Population Sciences.  
(Course is described under Department of Population Sciences.)

### **Health Services Administration 208a,b. Economic Analysis**

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Berry, Dr. Hemenway

This course is an introduction to microeconomic analysis, with the goal being for students to understand the way economists approach problems, to become comfortable with simple microeconomic models and concepts, and to recognize their uses and limitations. The course is largely a "tools" course and should provide a solid understanding of such economic concepts as "opportunity cost," "externalities," and "marginal analysis."

Required for students in the Health Policy and Management Program.

**Health Services Administration 208c,d. Economics of Health Care**

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Berry, Dr. Taylor.

This course is designed to provide an examination of the economic aspects of the production, distribution, and organization of health services. The course is devoted to applying the framework of economic analysis to the health services sector. Topics normally covered include the supply and demand of medical care facilities, markets for health manpower, financing of medical care, cost-benefit analysis, and problems of health planning.

Prerequisite: Interdepartmental 210a,b or equivalent.

Required for students in the Health Policy and Management Program.

**Health Services Administration 209c,d. Economics of Health Planning**

Seminars. *Two 1½-hour sessions each week. 5 units.* Mr. Hsiao.

This course is designed to apply economic analysis to planning of health programs. Application is emphasized over theory. The course examines planning and regulation in a market economy, and develops analytical tools which aid a planner, including econometrics, modeling, simulation, and cost-benefit analysis. Planning topics covered include health manpower, resource allocation, hospital facilities, and national health insurance. Skills in using analytical techniques appropriately are developed. Case study material is used.

This course is especially appropriate for students who intend to pursue a career in planning and evaluation of health programs.

Prerequisites: One semester each of statistics and microeconomics.

**Health Services Administration 211c,d. Administration of Personal Health Service Programs**

Seminars, field projects. *One 2-hour session each week. 2 units.* Dr. Kasten.

This course is designed for students who will be administrators of personal health service programs. Inpatient, ambulatory, home, and rehabilitation programs are treated from an operational and preventive perspective. Special emphasis is placed on administrative problem solving. Students analyze administrative problems in operating personal care service programs.

Enrollment is subject to the approval of the instructor.

**Health Services Administration 215c,d. An Introduction to Ambulatory Care Administration**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wilson.

This course deals with the concepts, problems, and issues involved in the administration of ambulatory care programs. Comparative models such



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as outpatient departments, neighborhood health centers, and group practice are discussed, including organization, operations, and manpower.

Prerequisite: Health Services Administration 203a, 203b, or permission of the instructor.

### **Biostatistics and Health Services Administration 216c,d. Health Program Evaluation**

Lectures, discussions. *One 2-hour session each week. 2 units each period.*

*216c may be taken without 216d.* Mr. Frazier, Dr. Feldman, Dr. Reed.

(Course is described under Department of Biostatistics.)

### **Health Services Administration 218c,d. The Sociology of Medical Care**

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Staff of the Division.

This course is organized along two major axes: (1) the importance of social factors as they bear on health and illness and as they affect the health care system; (2) the microsociological (clinical) and the macrosociological (societal) aspects of illness and its treatment. It is proposed to expose the students to clinical situations so that they will better understand the basic elements of the interaction between patients and health professionals.

This course or an accepted alternative is required for students in the Health Policy and Management Program.

### **Health Services Administration 244a,b. Political Analysis in Health Care (Public Policy 244)**

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Fineberg.

This course presents an introduction to political and bureaucratic considerations which affect the outcome of health programs. The course should improve the student's ability to predict the likely consequences of departmental, agency, institutional, and individual actions. It should also improve the student's ability to plan more effective implementation of health programs. The course is appropriate for students who will be involved in planning, initiating, and managing health programs.

This course or an accepted alternative is required for students in the Health Policy and Management Program.

### **Health Services Administration and Biostatistics 290d. Analysis of Health and Medical Practices (Public Policy 290)**

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Milton C. Weinstein (Associate Professor of Public Policy, John F. Kennedy School of Government).

Not given in 1976-77.

This course presents a systematic analysis of clinical procedures and health programs, and examines uses and limitations of quantitative methods such as decision analysis, cost-benefit analysis, and experimental designs. Topics include: treatment decision for acute abdominal pain; diagnosis of renovascular disease; screening for glaucoma; hernia and gall bladder surgery; coronary artery bypass surgery; emergency medical services; resource allocation for control of hypertension; statistical and welfare issues relevant to clinical experimentation.

Prerequisite: Some facility with quantitative methods, preferably with some elementary knowledge of statistics, decision analysis, or economics.

### **Health Services Administration 295c,d. Economic and Administrative Issues in Medical Care (Economics 2950b)**

Seminars. *One 2-hour session each week. 4 units.* Dr. Berry, Dr. Osler Peterson (Professor of Preventive Medicine, Harvard Medical School).

This seminar is concerned with the major issues of the medical care sector. During the first half of the course specific attention is given to issues of access to services, quality of care, and costs and inflation in the health sector. Alternative health care systems and planning are also considered. During the second half of the course student groups present their analysis of a specific significant issue in health or medical care. Throughout the course there is an emphasis on policy analysis.

### **Health Services Administration 300a,b,c,d,e. Tutorial Programs**

*Time and credit to be arranged.*

Students may make arrangements to do individual and group work under the guidance of a staff member of the division.

This work can include readings and special projects. In addition, field assignments to federal, state, and local government and to private health organizations can be arranged.

301 *Doctoral Seminar.* Dr. Berry.

302 *Research in Health Education.* Dr. Young, Staff of the Division.  
This tutorial aims to assist doctoral students and others interested in research methodology in health education to understand the elements of research design and to apply these elements in analyzing a number of research projects and in developing original research proposals. Special emphasis is given to evaluation research.

303 *Dentistry and Social Policy.* Dr. Yacovone.

305 *Seminar in Health Manpower Analysis.* Dr. Wechsler, Staff of the Division.

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- 315 *Applied Research Seminar*. Dr. Fineberg, Staff of the Division.  
Required for students in the second year of the Health Policy and Management Program.
- 316 *Special Projects in Health Services Administration*. Dr. Neuhauser.
- 317 *The Federal Government and Health: HEW and Federal Legislation*.  
Dr. Wilson.

### **Health Services Administration 330e. Assignments to Field Agencies**

*One-week period between fall and spring terms. 1 unit.*

Students are assigned to work on special projects, such as group surveys, other types of field projects, or observation of and limited participation in the work of health agencies. Field assignments are made on an individual basis to meet the special needs of each student insofar as possible. Work in the field is coordinated with courses in the division.

### **Health Services Administration 350. Research**

Doctoral candidates may register for Health Services Administration 350 to undertake individual study and research.

## **Division of Maternal and Child Health**

The division of maternal and child health is concerned with education and research in health services for mothers and children as a part of general health services and as they relate to other service systems (especially social services and education). Planning for the delivery of personal health and social services to mothers and children depends upon knowledge of:

1. The aspirational values which society places upon them, their special vulnerability to biological and environmental hazards, and the successive phases of biological change (growth and development);
2. The social situation and the way in which social services function as they affect the health of children and influence the child-care capability of families;
3. The health aspects of centers of early childhood education, and traditional and innovative practices in elementary and high schools.

The courses and tutorial work offered by the division are focused on actions which these characteristics demand for planning, administration, and evaluation of health care services. Maternal and child health services at international, national, and local levels, including services for handicapped children, are discussed in terms of integration with related health services in the community. In connection with this focus, the important roles of national governments, local health agencies, voluntary organizations, and community consumer groups are considered in seminars, observations of service programs in operation, or study of reports of such programs, foreign as well as domestic.

The division participates in the programs leading to the degrees of Master and Doctor of Public Health and Master and Doctor of Science. (For a description of the program leading to the degree of S.M. in Maternal and Child Health, see the section entitled "Admission and Degree Requirements and Academic Programs.") Fellowships are available for students who are concentrating in maternal and child health.

#### **Maternal and Child Health 101. Child Growth and Development**

*Self-instructional course. May be taken any period. 2.5 units.* Dr. Valadian. Individualized instruction in the physical growth, development, and maturation of children is presented in self-paced programmed material, supplemented as needed by conferences. The course covers topics which are necessary for advanced study of growth and development and which are basic for students who plan to be involved in medical or related social and educational services for children.

#### **Maternal and Child Health 201b, 201c. Child Growth and Development II: Advanced Seminar**

*Seminars. One 2-hour session each week. 2.5 units (or 1 unit if only one period elected).* Dr. Valadian.

This advanced seminar deals in depth with the physical growth and development and the maturation of children ("b" period) and with the factors affecting them ("c" period). Either period may be taken separately. A term paper is required.

Prerequisite: Maternal and Child Health 101 or permission of the instructor.

#### **Maternal and Child Health 202b. Primary Maternal and Child Health Care**

*Seminars, field visits. One 2-hour session each week. 1 unit.* Dr. Haggerty, Dr. Valadian, Staff of the Division.

Seminars and field observations focus on four different health centers in Boston. Faculty members participate in the visits and seminars, which are intended to relate the observed activities to maternal and child health and to crippled children's programs.

#### **Maternal and Child Health 203c,d. Programs in Maternal and Child Health**

*Seminars. Two 2-hour sessions each week. 4 units.* Dr. Haggerty, Dr. Valadian, Staff of the Division.

Beginning with planning for children, successive segments of the course include maternity, early childhood, later childhood, and adolescence and youth, to demonstrate how the health needs of children and their families change with the age periods of children. Seminars deal with programs, legislative developments, and research. Also included are field visits and student presentations based upon assigned readings.

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### **Maternal and Child Health 205d. Research Approach to Growth, Development, and Health of the Child**

Seminars. *Two 2-hour sessions each week. 2 units.* Dr. Valadian, Dr. Reed. Methods of obtaining and evaluating data on child growth, development, and health, and the construction of norms are studied, including the design of studies dealing with interrelationships among various aspects of the child's progress, background, and environment.

Enrollment is subject to the approval of the instructor.

### **Maternal and Child Health 206c,d. Maternal and Child Health in Developing Countries**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Joseph, Dr. Wray, Miss Cohn.

Using readings, discussions, and case presentations, this course considers issues of high priority in the health of mothers and children in developing countries, placing particular emphasis on the interactions between health and poverty in societies in rapid social and cultural transition. This course complements, but is not a substitute for, the issues raised in Interdepartmental 209c,d. Considerable reading is required to fulfill the course objectives.

### **Maternal and Child Health and Nutrition 207c,d. Nutrition in Child Growth and Development**

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Dwyer, Visiting Lecturers.

Principles and practical problems encountered in the nutritional aspects of child growth and development are examined. Lectures on general principles are designed to help students base their judgments on scientific evidence. Discussions deal with a variety of nutrition case studies and simulations illustrative of problems in both developing and highly industrialized countries.

### **Maternal and Child Health 208c,d. Rural Health Services**

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Joseph, Miss Cohn, Dr. Wray, Dr. Wyon.

Discussion focuses on the characteristics of "rural culture" and on problems in identifying and providing for the health needs of isolated communities. Five areas of concern are examined: Appalachia, the black South, migrant workers, Indian health, and the rural not-poor. However, the concepts discussed are pertinent to developing countries as well as the United States. After covering common issues, students work in small groups focusing on selected areas of interest. Field visits can be arranged.



**Maternal and Child Health 300b,c,d,e. Tutorial Programs**

*Time to be arranged. 2 or more units.*

Students may arrange to undertake an individual project or specialized reading under faculty supervision. Possible topics include: planning and evaluating health care services for mothers and children; public health nursing in family and community health programs; health services in rural sections of the United States and/or in developing countries; child growth and development. Advance approval by the Head of the Department of Health Services is required.

**301** *Group Tutorial in Development Planning.* Dr. Joseph.

This group tutorial is given jointly with groups from the Graduate School of Education, the School of Design, and the Department of Economics, through the Harvard Institute of International Development. It involves a semester-long case study in multidisciplinary development planning.

**Maternal and Child Health 330. Field Study**

*One-week period between fall and spring terms. 1 unit.*

Field study is available in: (1) Puerto Rico (in cooperation with the Department of Human Development, School of Public Health, University of Puerto Rico) to observe regionalized programs in maternal and child health, for handicapped children, and in family planning; and (2) Boone, North Carolina (in cooperation with Appalachian State University) to observe rural health programs for mothers and children. Enrollment is limited and requires approval of the Head of the Department of Health Services *before the end of the first period.*

**Additional Field Study**

Students who lack sufficient previous experience are encouraged to undertake a period of field study before registration or after completion of the academic year, in a program arranged by the staff of the division. No credit is allowed for such field study.

**Maternal and Child Health 350. Research**

Doctoral students may undertake research in maternal and child health by arrangement with the Head of the Department of Health Services.

## DEPARTMENT OF MICROBIOLOGY

Roger L. Nichols, A.B., M.D., A.M. (hon.), Irene Heinz Given Professor of Microbiology, Head of the Department, and Associate Director of the Center for the Prevention of Infectious Diseases

*Faculty:* Professor Murray; Associate Professors Cerny, Essex, MacDonald, and Vinson; Assistant Professors Buckley, Fraser, Herrmann, and Modabber; Lecturers Lambe and Madoff

*Teaching and Research Staff:* Lecturers Fiumara, Gilfillan, Grady, and Wright; Instructor M. Benfari; Research Associates Cotter, Eisenstadt, Girard, Greenberger, and Stiller; Assistants Levine, McComb, Rota, and Spielman

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Infectious diseases remain a major health problem in both developed and underdeveloped countries. Microbiologists must be concerned not only with prevention and treatment but with policy formation, administration, and research if the problems of infectious disease are to be solved. In conjunction with the Department of Tropical Public Health in the Center for the Prevention of Infectious Diseases, the Department of Microbiology provides education for leadership in control of infectious diseases. Emphasis is placed on decision making in diagnostic and surveillance programs; judging the uses and limitations of public health systems; and study of fundamental microbiological and immunological problems related to infectious disease. The deleterious effects of infectious disease, for the individual or for the community, are related to changing political, social, and economic patterns which impinge on the microbe-host relationship.

A major objective of the Department is to train students to think of infectious disease in the context of epidemiology. Advances in immunology have extended the scope of inquiry required of microbiologists to autoimmune disorders, hypersensitivity phenomena, variations in host response, cancer, and immunological surveillance mechanisms.

Candidates for the degree of Master of Science in Microbiology must demonstrate competence in microbiology and immunology; they must understand the problems and opportunities in the control of infectious disease in developed as well as underdeveloped countries. A minimum of 20 credit hours of formal course work offered or approved by the Department will satisfy this requirement, together with any additional courses suggested by the student's adviser within the Department, in the School, or in nearby academic institutions. The remainder of the program may be taken as additional formal courses, tutorials, or supervised research. Detailed information on degree programs offered by the Department may be found in the section entitled "Admission and Degree Requirements and Academic Programs."

The Department offers programs leading to the degrees of Doctor of Public Health or Doctor of Science. Qualified students interested in research training

may be admitted to either of these programs. During the first year of a provisional doctoral candidacy, students are expected to enroll in advanced courses in microbiology, immunology, and related fields in the School of Public Health, the Harvard Medical School or other areas of Harvard University, or the Massachusetts Institute of Technology. Doctoral candidates must plan at least one year in residence beyond completion of the master's degree. Most of the training beyond the master's degree is occupied by completion of a research project and preparation of a thesis.

The Department maintains close liaison with the Harvard Medical School and with several Harvard-affiliated hospitals. It houses the Center for Study of Sexually Transmitted Diseases funded by the National Institutes of Health; other units in this Center include the Department of Tropical Public Health; the Channing Laboratory for Infectious Diseases, Harvard Medical School; and the Infectious Disease Unit, Peter Bent Brigham Hospital.

### **Tropical Public Health and Microbiology 201a,b. Ecology and Epidemiology of Infectious Diseases**

Lectures, seminars, demonstrations; laboratory elective. *Four 1-hour sessions and one 2-hour elective laboratory session each week, first period; one 1-hour session and two 2-hour sessions each week, second period. 5 units; 6 units if laboratory elected.* Dr. Weller, Dr. Nichols, Staffs of the Departments.

(Course is described under Department of Tropical Public Health.)

### **Microbiology and Tropical Public Health 202b. Critiques of Current Literature on Infectious Diseases**

Seminars. *One 2-hour session each week. 1 unit.* Dr. Chernin, Dr. Buckley, Staffs of the Departments.

This course is required of all students concentrating in microbiology or tropical public health. Papers on topics of general interest are selected from current periodicals and critically reviewed as to soundness of experimental design, validity and significance of results and conclusions, organization of manuscripts, and clarity of presentation.

Enrollment of nondepartmental students is subject to the approval of the instructors.

### **Microbiology 203d. Clinical Problems in Infectious Diseases**

Lectures, clinics. *One 2-hour session each week. 1 unit.* Dr. Louis Weinstein (Visiting Professor of Medicine, Harvard Medical School).

Problem cases concerning diagnosis, treatment, and control of the common acute communicable diseases of temperate climates are presented, together with discussions of infectious diseases that are usually not considered communicable.

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### **Microbiology 204c. Public Health and Laboratory Aspects of Infectious Diseases of Microbial Origin**

Seminars, laboratory exercises. *Two 3-hour sessions and one 1-hour session each week. 2.5 units.* Dr. Murray, Dr. Nichols, Dr. Essex, Dr. Herrmann, Ms. Rota, Staff of the Department.

Primary orientation is toward the epidemiologist. Students perform in detail cultural, immunological, and biochemical techniques, e.g., toxin assays, immunofluorescence, complement fixation, and neutralization tests. Viruses, bacteria, and rickettsiae are inoculated into embryonated eggs, tissue culture, and animals for study of immunologic or growth characteristics.

Enrollment is limited; prior approval of the instructors is required.

### **Microbiology 207a. Fundamentals of Immunology**

Lectures. *Three 1-hour sessions each week. 2.5 units.* Dr. MacDonald, Dr. Cerny, Dr. Fraser.

This course explores the fundamental principles of immunology and host defense mechanisms. Many aspects of immunology will be studied, including humoral and cellular phenomena.

The course is intended to allow those individuals with no previous exposure to the field to become acquainted with essential principles; it will serve as a review for those wishing to expand their knowledge of immunology or reappraise their attitudes in a burgeoning field.

### **Microbiology 208b. Immunology of Infectious Diseases**

Lectures. *Two 1-hour sessions each week; discussion sessions to be arranged. 2.5 units.* Dr. MacDonald, Dr. Cerny, Dr. Fraser, Dr. Essex.

A number of diseases are selected for discussion from an immunological point of view, and their host defense mechanisms are studied. Examples include immunology of mucosal surface infections such as gonorrhea, trachoma, or cholera; pathogenesis of antigen-antibody complexes in streptococcal infections; immunology of malaria, cancer, and tuberculosis; problems associated with mycotic infections; and host defense mechanisms to smallpox and measles.

Prerequisite: Microbiology 207a or equivalent.

### **Microbiology 209b. Laboratory in Immunology**

Laboratory. *Two 3-hour sessions each week. 2.5 units.* Dr. MacDonald, Dr. Cerny, Dr. Fraser, Ms. Rota.

The laboratory consists primarily of recently developed techniques which can be utilized in the study of infectious diseases. These techniques will include isolation and modification of antigens, radio-immunoassay, immunoplaque assay, isolation of antibodies, fluorescence labeling, im-

munoabsorption, phagocytosis, migration inhibition factor, blast transformation, virus neutralization, and complement fixation.

Prerequisite: Microbiology 207a or equivalent. Enrollment is limited; prior approval of the instructors is required.

**Microbiology 211b. Medical Mycology**

Laboratory, conferences, field exercises. *One 3-hour session and 3 hours of individual laboratory work each week. 2 units.* Dr. Buckley.

This course introduces physicians and microbiologists to laboratory and field research and to clinical studies in medical mycology. No prior knowledge of the mycoses is assumed.

Enrollment is subject to the approval of the instructor.

**Microbiology 213d. Intracellular Microorganisms Pathogenic for Man**

Laboratory exercises, seminars. *Two 3-hour sessions each week. 2 units.* Dr. Murray, Dr. Nichols, Dr. Herrmann, Ms. Rota, Staff of the Department. This course provides an understanding of the techniques available for studying the growth and the characteristics of representative strains of rickettsiae, chlamydiae, and viruses which are human pathogens. Under staff supervision, each student performs the procedures for identification and characterization of unknown pathogens.

Prerequisite: Microbiology 204c or equivalent. Enrollment is limited to 10 students with prior approval of the instructors.

**Tropical Public Health and Microbiology 214c,d. Case Studies in Epidemiology of Infectious Disease**

Seminars, laboratory exercises. *One 2-hour session each week. 2.5 units.* Dr. Hopkins, Dr. Langmuir (Visiting Professor of Epidemiology, Harvard Medical School), Dr. Nichols.

(Course is described under Department of Tropical Public Health.)

**Microbiology 215d. Problems in Medical Bacteriology**

Seminars, laboratory demonstrations. *One 3-hour session each week. 1 unit.* Dr. Buckley.

This course covers bacteriologic problems of particular interest to students which are not considered in Tropical Public Health and Microbiology 201a,b. Course content is assembled around the students' interests. The course is given only if the instructor receives at least six individual requests before the end of the second quarter.

**Microbiology 216d. Sexually Transmitted Diseases**

Lectures, seminars. *One 2-hour session each week. 1 unit. Additional credit may be arranged.* Staff of the Department, Guest Lecturers.

Discussion centers on why sexually transmitted diseases that are easily



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cured are out of control. Reviewed topics include pathobiologic, epidemiologic, and biosocial aspects of venereal diseases, such as patterns of sexual behavior, lay and professional attitudes toward venereal disease and patients, and legal and economic aspects of control. Interaction of students from both social and medical sciences benefits the examination of possible new approaches for dealing with the problems.

### Microbiology and Tropical Public Health 217d. Virology

Lectures, seminars. *Three 1-hour sessions each week. 2.5 units.* Dr. Essex, Dr. Waner.

The course is structured to provide students with fundamentals of human virology and introduces the new and relevant concepts emanating from recent and ongoing research. Topics include virus-host cell interaction, pathogenesis, chronic and latent infections, epidemiology, environmental factors, host defense mechanisms, and community control measures. Selected virus groups are discussed in detail.

### Microbiology 300a,b,c,d. Tutorial Programs

*Time and credit to be arranged.* Staff of the Department.

Enrollment requires the consent of the staff member responsible for supervision of the research. The various subject areas are listed below by category.

#### 301 *Pathogenic Fungi.* Dr. Buckley.

Immunological characterization of the antigenic mosaic of *Candida* and *Cryptococcus spp* and other "opportunistic" fungi in compromised patients. Factors responsible for dissemination and immunological reconstitution of "at risk" hosts.

#### 302 *Rickettsiae.* Dr. Murray.

The biology, immunology, and epidemiology of typhus, Rocky Mountain spotted fever, scrub typhus, and trench fever may be studied in the laboratory or in field operations in Yugoslavia, Tunisia, Mexico, and Cape Cod, Massachusetts. Biologic systems include infected animals, chick embryos, cell cultures, human body lice, and oriental rat fleas. Immunology embraces immunoglobulin and cell-mediated immune responses and antigenic analyses of rickettsiae, as well as logic procedures and vaccines.

#### 303 *Chlamydiae.* Miss McComb, Dr. Murray, Dr. MacDonald, Dr. Nichols.

Laboratory and field research in trachoma, inclusion conjunctivitis, psittacosis, lymphogranuloma venereum, and the diseases caused by the chlamydial agents in humans and animals. Students are welcome to do laboratory and, occasionally, field investigations.

- 304 *Viruses*. Dr. Essex, Dr. Herrmann, Dr. Cerny, Dr. Fraser.  
Isolation and identification of representative viruses by use of cell culture, animal inoculation, and serologic techniques.
- 305 *Immunochemical Methods*. Dr. MacDonald, Dr. Herrmann.  
Experiments with immunofluorescence, chromatography, immunoelectrophoresis, enzyme-coupled antibody, labeled isotopes, and other techniques applied to research on microorganisms and mechanisms of hypersensitivity.
- 306 *Public Health Laboratory*. Associates at the State Laboratory Institute.  
The State Laboratory Institute is engaged in a variety of programs related to public health. These include the development, preparation, and testing of new and standard serums, vaccines, and blood fractions; research in various aspects of applied immunology; various aspects of diagnostic service in the fields of bacteriology, virology, and congenital metabolic disorders; and field studies on arboviruses. Individual arrangements for study can be made in any of these programs.
- 307 *Tumor Biology*. Dr. Essex, Dr. Cerny.  
Approaches and techniques for the study of cancer as an infectious disease. Procedures used to study tumor cell and tumor virus marker antigens and antibodies are demonstrated. The significance of these markers for epidemiological, etiological, and diagnostic investigations of various tumor systems of known and unknown cause is discussed. The relationship between the immune response and the oncogenic process is also examined.
- 308 *Cellular Immunology*. Dr. Cerny, Dr. Essex.  
Differentiation of cells producing antibody of various classes *in vivo* and *in vitro*. The studies involve the use of a number of immunological methods, but principally the agar plaque technique. The major experimental model utilized is immune response to cell wall antigens of *Vibrio cholerae*. The research also involves experiments on interaction between antibody-forming cells and leukemic viruses in mice and studies on mechanism of virus-induced immunosuppression.
- 309 *Susceptibility to Infectious Disease*. Staff of the Department.  
Directed reading on the broad subject of susceptibility to infectious disease. Emphasis is on malnutrition and relevant immunodeficiency syndromes. Field work is possible by arrangement.
- 310 *Venereal Disease*. Dr. Nichols, Dr. Murray.  
The departmental research on venereal diseases, especially gonorr-

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rheae and the chlamydial diseases, spans biology, immunology, microbial physiology, and epidemiology. Student participation in ongoing project areas is encouraged.

311 *Health Problems in Selected Underdeveloped Countries.* Dr. Nichols.

Problems are studied in the historical context of their political, socioeconomic, and cultural development. Extensive reading assignments are discussed in small seminars. Students with experience in international health are preferred.

### **Microbiology 350. Research**

Qualified doctoral candidates, research fellows, and full-time special students may register for Microbiology 350 to undertake original research in virology, rickettsiae, mycology, bacteriology, immunology, or in one of the disciplines available at the State Laboratory Institute. A number of the current research activities of the Department of Microbiology are indicated under Microbiology 300. Inquiries about specific research opportunities should be addressed to the Head of the Department.

## DEPARTMENT OF NUTRITION

Robert P. Geyer, S.B., S.M., Ph.D., Professor of Nutrition and Acting Head of the Department

*Faculty:* Professors Hegsted, Lown, and Stare; Associate Professors Antoniadou, Gershoff, Hayes, Herrera-Acena, and Kerr; Assistant Professors Christiansen, Huber, el Lozy, Mora, Sachdev, Samonds, Temte, Thenen, Verrier, Voukydis, Westmoreland, and Witschi; Lecturer Austin

*Teaching and Research Staff:* Visiting Lecturer Levinson; Research Associates Ausman, Boelkins, Gallina, Graboyes, Horn, Lynch, Miller, Nicolosi, Rabinowitz, Remmell, D. Thomas, and Whelan; Assistants Bruno, Duffett, and Gallagher

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The Department of Nutrition is concerned with basic and applied investigations in the science of nutrition in the areas of biochemistry, physiology, pathology, and psychology. Many of these are oriented toward problems of contemporary public health importance, such as cardiovascular diseases, obesity, and diabetes. The Department is also concerned with the economic areas of nutrition, such as planning and applied interventions. The Department has programs dealing with general nutritional and health problems in the United States and in various countries in South America, Africa, and Asia.

The core curriculum required of all master's students within the Department consists of the following courses: Public Health Nutrition; Nutrition Policy Formation and Program Operation; the Departmental Seminar; Biochemistry and Physiology of Nutrition; Principles of Epidemiology; Principles of Biostatistics; and a course in biochemistry. Students coming from relevant non-science disciplines may have interests in applied nutrition areas. These students may not have the bioscience background to meet the biochemistry requirements of the Department. Nonetheless, they are viewed as an important constituency of the Department of Nutrition, and their needs can be addressed. This implies close coordination with other departments.

### **Nutrition 201a,b. Selected Topics in Public Health Nutrition**

Lectures. *One 2-hour session each week. 2 units.* Dr. Gershoff.

The course deals with selected topics in human nutrition and the application of nutrition programs to public health. The course is concerned with nutrition problems of developing countries, such as nutritional deficiency diseases, famine, and the relationship of food and nutrition programs to socioeconomic development. It is also concerned with nutrition problems in industrialized countries, such as obesity, nutrition and cardiovascular disease, food safety, and nutrition programs in the United States.

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### **Nutrition 202a,b. Public Health Nutrition**

Lectures, discussion. *Two 2-hour sessions each week. 5 units.* Dr. Hegsted.

The development and evaluation of nutrition programs depends upon estimates of nutritional needs, evaluation of nutritional status, and identification of health problems related to nutrition. This course deals with methodologies available for these purposes. Consideration is given to the collection and use of food and nutrient consumption, biochemical, clinical, anthropometric, and demographic information. The application of these methods in the evaluation of problems which may require different methods of intervention is emphasized.

### **Nutrition 203c,d. Nutrition Policy Formation and Program Operation**

Lectures, discussion. *Two 2-hour sessions each week. 5 units.* Dr. Austin.

This course deals with the formation of food and nutrition policies and the operation of nutrition intervention programs aimed at the major nutritional problems in the United States and in the developing nations. The course employs a multidisciplinary and case study approach to develop skills in analyzing and formulating nutrition policies and plans, and to sharpen problem-solving and decision-making capacities regarding nutrition program operation.

Prerequisite: Nutrition 202a,b or permission of the instructor.

### **Nutrition 204a,b,c,d. Departmental Seminar**

Seminars. *Two 1-hour sessions each week. 4 units.* Dr. Thenen, Dr. Westmoreland.

Students are expected to summarize and criticize recent publications in the general field of nutrition. Attention is placed on validity of experimental designs in nutritional research. Topics include the biochemical, physiological, behavioral, and clinical aspects of nutrition.

### **Nutrition 205c,d. Biochemistry and Physiology of Nutrition**

Lectures, discussions, required reading. *Two 2-hour sessions each week. 5 units.* Dr. Hayes, Staff of the Department.

The biochemical and clinical aspects of the metabolism of carbohydrates, fats, proteins, vitamins, and essential minerals are considered in detail, with students actively participating in discussion of the material.

Prerequisite: A recent course in biochemistry. The course is intended for students majoring in nutrition but may be taken by others with consent of the instructors.

### **Nutrition 206c,d. Laboratory and Animal Research Techniques**

Lectures, demonstrations. *One 3-hour session plus 2 additional hours each week. 5 units. Reduced credit may be arranged for students not*



*majoring in nutrition.* Dr. Geyer, Dr. Antoniadis, Staff of the Department. By means of discussions, laboratory work, and tutorial instruction this course affords the opportunity to learn the principles and practice of modern experimental animal and laboratory research techniques. The schedule is so arranged as to allow the student to simultaneously participate in a variety of ongoing research projects involving animals and/or mammalian cell cultures, and to conduct instrumental and noninstrumental laboratory procedures.

**Maternal and Child Health and Nutrition 207c,d. Nutrition in Child Growth and Development**

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Dwyer, Visiting Lecturers.

(Course is described under Department of Health Services.)

**Nutrition 208c,d. Nutritional Aspects of Human Disease**

Lectures, discussions, demonstrations. *One 2-hour session each week. 2.5 units.* Dr. Kerr, Staff of the Department.

This course reviews the role of specific nutrients in the causation and therapy of such clinical diseases as coronary heart disease, obesity, dental caries, anemia, alcoholism, renal disease, malabsorptive states, diabetes mellitus, infection, and inborn errors of metabolism. In addition to considerations of the primary care of individuals with these disorders, emphasis is placed on public health concepts of education, prevention, and early detection of nutrition-related diseases.

**Nutrition 209a,b. Food Science and Nutrition**

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Mrs. Witschi, Dr. Samonds, Staff of the Department.

This course deals with nutrition in terms of the foods which supply mankind's nutrient needs, their composition and physical properties, and the positive and negative effects on nutrient qualities of food by genetic manipulation, agricultural practice, processing, storage, and cooking. The historical development of food technology, including methods of preservation and sanitation, is related to current methods employed in both developing and industrialized countries.

**Nutrition 300a,b,c,d,e. Tutorial Programs**

*Time and credit to be arranged.*

Individual work, under direction, may be arranged for students at the master's level. This may include laboratory studies or projects in applied nutrition.

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### Nutrition 350. Research

*Time and credit to be arranged.*

Facilities are available for students at the doctoral level to do advanced work in nutrition along the lines of fundamental research or applied nutrition in public health and medicine. Areas currently receiving intensive and comprehensive study in the Department are as follows:

The effect of nutrition and other environmental factors on the etiology of heart disease in man; nutrition education; fluoride in human nutrition as a preventive for tooth decay and osteoporosis; cooperative international researches in nutrition (*Dr. Stare*).

The nutritive value of proteins and protein requirements; dietary effects on the metabolism of cholesterol in animals and man; the influence of diet on the metabolism of adipose tissue; nutritional requirements for calcium and for bone formation (*Dr. Hegsted*).

Lipid metabolism in tissue culture cells; polyvalent metal metabolism in soft tissue; effects of CO<sub>2</sub> deprivation on tissue culture cells, parenteral nutrition, and artificial blood substitutes (*Dr. Geyer*).

The effects of nutritional deficiencies on endocrine metabolism; the etiology of urolithiasis in experimental animals and man; vitamin metabolism; interrelationships between nutrition and endocrine function (*Dr. Gershoff*).

Coronary artery disease; etiology of sudden death; derangements of the heart beat; exercise physiology; electrolyte metabolism (*Dr. Lown*).

Protein isolation and characterization; hormone biochemistry and metabolism (*Dr. Antoniades*).

Endocrine, nutritional, and metabolic aspects of diabetes and hyperlipidemia. Mental development and learning capacity as affected by malnutrition (*Dr. Herrera-Acena*).

Nutritional pathology with specific interest in lipid metabolism, atherosclerosis, and the fat-soluble vitamins (*Dr. Hayes*).

Primatology, particularly nutrition as it relates to fetal and child development (*Dr. Kerr*).

Biochemical aspects of folic acid and vitamin B<sub>12</sub> deficiencies and ascorbic acid excess, and their effects on growth, reproduction, hemopoiesis, and disease resistance; metabolism of obesity in rodents (*Dr. Thenen*).

Electron microscopic morphology and histochemistry of atherosclerosis, smooth muscle cells in tissue culture, arterial connective tissue, and blood thrombi produced by Factor XIIa (*Dr. Westmoreland*).

Trace mineral metabolism (*Dr. Huber*).

Nutrition policy formation, nutrition intervention design, and the developmental and managerial aspects of food systems within the United States and in developing countries (*Dr. Austin*).

Computer-based interactive dietary history, analysis, and counseling programs (*Mrs. Witschi*).

Epidemiology of sudden death, detection/treatment of arrhythmias, biophysics of electrocardiology, and computer applications in cardiology (*Dr. Voukydis*).

Nutritional potential and synthesis of non-nitrogenous precursors and analogs of essential amino acids; mechanism-based, intra-active site-released enzyme inhibitors as hypoglycemic and hypocholesteremic agents; lipid metabolism, prostaglandins, cyclic AMP, polymer-supported enzymes and hormones, cancer chemotherapy, and new synthetic methods (*Dr. Sachdev*).

Anthropometric methods in the assessment of nutritional state; mathematical models of the growth of normal and malnourished humans and animals (*Dr. el Lozy*).

The etiology of protein-calorie malnutrition in young primates, amino acid requirements and protein quality, and the efficacy of amino acid analogs to replace their corresponding amino acids (*Dr. Samonds*).

The epidemiology of malnutrition, physical growth deficit, and cognitive retardations (*Dr. Mora*).

The social correlates of malnutrition and cognitive retardation; urban poverty and the utilization of health services (*Dr. Christiansen*).

Influence of neural factors, psychologic conditioning, and myocardial ischemia on susceptibility to ventricular arrhythmias and sudden death (*Dr. Verrier*).

Admission is limited and is subject to the approval of the instructor.

## DEPARTMENT OF PHYSIOLOGY

James L. Whittenberger, S.B., M.D., A.M. (hon.), James Stevens Simmons  
Professor of Public Health, Professor of Physiology, and Head of the Department

*Faculty:* Professors Ferris, Little, Mead, Peters, and Roberts; Associate Professors Amdur, Brain, Hoppin, D. E. Leith, McGandy, and S. Murphy; Assistant Professors Dawson, Fine, Goldman, Jaeger, Kennedy, Sorokin, Underhill, Wegman, and Williams; Lecturers R. Murphy, Snook, and Spencer

*Teaching and Research Staff:* Research Associates Boden, J. Butler, Eisenstadt, Gold, Jackson, Lewis, Nagasawa, Ritter, and Valberg; Assistants Cherry and Vetrovs

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The Department of Physiology has interests which include physiology as a basic medical science. The Department's concerns, however, extend beyond pure physiology to encompass a broad spectrum of environmental health problems. The biologic effects of air pollutants, of pesticides, and of radiation are typical problems that have been central to the Department's interests. Such broad problems require the insights of many specialties, and the personnel of the Department reflect this. The staff includes physicians, physiologists, engineers, toxicologists, and specialists in radiobiology and occupational medicine. Students and research fellows come with similarly varied backgrounds.

A major objective of the Department is to provide students with basic information on the relationship of man to his physical and chemical environment. The course Environmental Health Interdepartmental 201a, 201b introduces M.P.H. candidates to fundamental concepts regarding the measurement of both the quality of the environment and its impact on man. These concepts are examined in detail in specialized courses such as Principles of Toxicology and Radiation Biology. Specific research projects of members of the Department offer students an opportunity to gain experience in, and to develop a capacity for, critical evaluation of research methods. Qualified individuals may enroll in a program leading to a doctoral degree.

The research programs include topics such as cellular effects of ionizing radiation, mechanisms of carcinogenesis and mutagenesis, toxic interactions of particles and vapors, inhalation toxicology, pesticide metabolism and toxicity, comparative respiratory physiology, and the deposition and clearance of particles in the respiratory tract. Other research areas are the mechanical properties of lungs and chest wall, including mathematical modeling, mechanisms of flow limitation, and development of pulmonary function tests and testing equipment.

**Physiology 203a,b. Human Physiology**

Lectures, conferences, demonstrations. *Three 2-hour sessions each week. 5 units.* Dr. Leith, Staff of the Department.

Students lacking a background in biology are offered an intensive introduction to biological principles and to the physiology of cells, organ systems, and organisms. Some pathophysiology and a number of laboratory exercises are included. After a period of "remedial biology," the course joins Interdepartmental 213a,b for most of the semester.

Prerequisites: College courses in physics, chemistry, and mathematics, or permission of the instructor.

**Physiology 205c,d. Principles of Toxicology**

Lectures, laboratory demonstrations. *Two 2-hour sessions each week. 5 units.* Dr. Amdur, Dr. Murphy, Dr. Jaeger.

This course deals with injurious effects of foreign chemicals. Emphasis is on basic toxicologic data leading to an understanding of such effects. History, methods, and basic principles of toxicology are discussed. Toxic chemicals are discussed in terms of damage to specific organ systems. Specific problem areas of public health, such as pesticides, air pollution, teratology, food additives, and carcinogenesis, are discussed.

Prerequisites: College chemistry and physiology. Required of students offering a major or minor concentration in toxicology.

**Physiology 207c,d. Radiation Biology**

Lectures. *Three 1-hour sessions each week.*

Laboratory. *One 2-hour session each week. 5 units.* Dr. Little.

This course is divided into two parts: cellular and mammalian radiobiology. The first includes radiation chemistry; cell survival, transformation, and aging; chromosomal effects; UV-photobiology; and cellular and molecular repair processes. The second part covers the acute and long-term effects of radiation in man, as well as the characteristics of internal and external human exposure. The biologic basis of the acute radiation syndrome, and the human epidemiologic data for radiation carcinogenesis, are emphasized.

Prerequisite: Physiology 203a,b or equivalent. The lectures may be taken without the laboratory with consent of the instructor. The laboratory will not be offered for less than 5 students.

**Physiology 208a,b,c,d. Seminar in Toxicology**

Lectures, seminars. *One 1-hour session each week. 2 units (0.5 units each period).* Dr. Murphy, Dr. Amdur, Dr. Jaeger.

This course consists of seminars and discussion of topics in basic research, current literature reviews, applied problem areas, and legislative



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matters in toxicology. Topic themes vary from year to year; students concentrating in toxicology are expected to register each year. Students who wish to offer toxicology as an area for doctoral examinations should register at least one year in this course.

Enrollment is subject to the approval of the instructor.

### **Physiology 209a,b. Molecular and Cellular Processes in Radiobiology**

Lectures. *One 2-hour session each week.*

Laboratory. *Individual work to be arranged. 5 units.* Dr. Williams.

The effects of radiations on mammalian cells in culture are studied in detail with special emphasis on hit and target theory analysis, nucleic acid metabolism, synergism and antagonism with physical and chemical agents at the molecular level, and the role of molecular repair in survival. Students are given original problems in radiobiology to solve using cultured mammalian cells.

Prerequisite: Physiology 207c,d or permission of the instructor.

### **Physiology 210a,b. Advanced Toxicology**

Lectures, discussion. *One 2-hour session each week.*

Laboratory, conferences. *4 hours each week, to be arranged. 5 units.* Dr. Jaeger, Dr. Murphy, Dr. Amdur.

The purpose of this course is to provide an in-depth understanding of the biological and chemical mechanisms of action of toxic substances and an introduction to laboratory methods for research in toxicology. The course is primarily intended for students who plan careers of research in toxicology or other disciplines concerned with chemical-biological interactions.

Prerequisite: Previous completion of or concurrent registration in Physiology 205c,d, or permission of the instructor. This course will be given only if registration warrants.

### **Physiology 300. Tutorial Programs**

*Time and credit to be arranged.*

Opportunities are provided for tutorial work at a master's degree level in the fields of respiratory physiology, toxicology, occupational medicine, and radiobiology.

### **Physiology 350. Research**

Doctoral candidates and other properly qualified students may undertake laboratory or field research by arrangement with the Head of the Department.

## DEPARTMENT OF POPULATION SCIENCES

George S. Masnick, A.B., A.M., Ph.D., Associate Professor of Demography and Head of the Department

*Faculty:* Professors and Visiting Professors Alonso, Dyck, Keyfitz, Levins, Revelle, Salhanick, Thomas, and Wray; Associate Professors W. Berggren and Repetto; Assistant Professors G. Berggren, Ewbank, McIntosh, and Morgan; Senior Lecturer Wyon; Lecturers Frisch and D. Korten

*Teaching and Research Staff:* Lecturers and Visiting Lecturers Gavan, Guerrero, Kline, F. Korten, Morehead, Plank, Strauss, and Vaillant; Research Associates Holtrop, Morales, Uzgiris, and Whipple; Consultants Gamble, Goldstein, and C. Thomas

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Acting under the conviction that rapid population growth was thwarting efforts to provide better housing, education, nutrition, health services, and medical care, and that the disparity between rates of population increase and rates of development of human and economic resources is a crucial problem confronting society, the School of Public Health established the Department of Demography and Human Ecology in 1962 (renamed the Department of Population Sciences in 1969) and the Center for Population Studies in 1964. As the view of the role of population change in health and welfare has matured, increasing attention has been given to questions of the broader interrelations between population structure, health and welfare, and social change.

Faculty affiliated with the Department are specialists in demography, ethics, epidemiology, economics, sociology, ecology, genetics, business, psychology, and medicine. The formal courses and the tutorial instruction of the Department are planned to prepare students for effective participation in population programs as administrators, research workers, or educators. Programs of study are offered in the following areas: (a) population, health, and nutrition; (b) the design, management, and evaluation of population programs; (c) the analysis of complex ecological systems; (d) demographic analyses; and (e) reproductive biomedicine.

The Department participates in the School of Public Health's one- and two-year Master of Science programs, the Master and Doctor of Public Health programs, and the program leading to the Doctor of Science degree. (A description of the program leading to the degree of Master of Science in Population Sciences may be found in the section entitled "Admission and Degree Requirements and Academic Programs." General descriptions of the Master of Public Health and doctoral programs are also included in that section.)

The Department Office has information on courses related to population which are available elsewhere in the University.

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### **Population Sciences 130a,b. The American Household in Historical and Demographic Perspective (Sociology 130)**

Lectures. *Two 1-hour sessions each week. 5 units.* Dr. Masnick.

The course focuses on the dynamic structure of the American household from colonial times to the present. The size, composition, age structure, and stability of the household are examined in view of changes in mortality, fertility, marriage, and divorce. Sociological determinants and consequences of these intermediate variables are developed. Particular attention is given to the pattern of age and sex segregation that has emerged as the characteristic feature of the modern American household experience.

### **Population Sciences 185a,b. Applied Mathematical Demography (Sociology 185)**

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Keyfitz.

Topics covered by this course include probabilities of survival and of childbearing; the general one-sex model and the stable special case; parity and interbirth intervals; cohorts and periods; and extension to two sexes and to changing rates of birth and death. Also covered are application to population prediction, inferring birth rates from censuses, occupational mobility, migration, kinship, and effects of birth control.

Prerequisites: Population Sciences 203c,d and a year of calculus, or permission of the instructor.

### **Population Sciences 190c,d. Ecology and the Spatial Distribution of Population I (Sociology 190)**

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Keyfitz, Dr. Alonso.

Topics covered by this course include the environment and its population-carrying capacity as a function of technology; limits of growth set by raw material shortages and pollution; agriculture and transport as determinants of population distribution; poles of development; territoriality, nationhood, and population growth; and the dynamics of migration.

### **Population Sciences 191a,b. Ecology and the Spatial Distribution of Population II (Sociology 191)**

Lectures. *One 2-hour session each week. 5 units.* Dr. Alonso, Dr. Keyfitz. Not given in 1976-77.

Topics covered by this course include urbanization in history, in the developing countries and in postindustrial society; the principle of median location, positive externalities including forward and backward linkage, transport constraints, and other forces making for centralization; chronically backward regions within rich countries; and housing as a worldwide problem.

**Population Sciences 200a,b. Determinants, Consequences, and Control of Population Growth**

Lectures, seminars. *Two 1-hour sessions and one 2-hour seminar/ laboratory session each week. 5 units.* Dr. Ewbank, Staff of the Department.

The determinants of population growth are births, deaths, and migrations. The biosocial forces regulating each of these are examined, and the consequences of continued rapid population increase and alternative projections are considered. The physiology of reproduction is reviewed and methods and programs for its control are evaluated. The ethical and policy issues of births and population growth are also discussed. Concepts are illustrated by historical and current references. A term paper is required.

**Population Sciences 201a,b. Determinants, Consequences, and Control of Population Growth**

Lectures. *Two 1-hour sessions each week. 2.5 units.* Dr. Ewbank, Staff of the Department.

This course consists of the lecture series for Population Sciences 200a,b. It is intended only for those students who are not concentrating in the Department of Population Sciences and who are unable to fit the full course (200a,b) into their schedules.

**Population Sciences 202c,d. Departmental Seminar**

Seminars. *One 2-hour session each week. 2 units.* Staff of the Department. This course is oriented toward the research interests of those concentrating in the Department. Each student selects a topic for special study, concerning which he presents a critical survey of the relevant literature and later the design of a project which would provide new information. During the initial sessions, and on occasion thereafter, staff members and guests report on their own investigations.

**Population Sciences 203c,d. Demographic Methods**

Lectures. *Two 2-hour sessions each week.*

Laboratory. *2 hours each week. 5 units.* Dr. Ewbank, Dr. Masnick.

Ways of measuring mortality, fertility, and migration, projecting future populations, and adjusting and correcting data are presented. In addition, the course is concerned with the design and analysis of fertility and migration surveys, methods for evaluating family planning and other population programs, and ways of organizing data for computer-aided analysis.

Prerequisite: Biostatistics 101a,b or permission of the instructor.

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### **Population Sciences 204c,d. Biological Basis for Fertility Control**

Lectures. *Two 1-hour sessions each week, with a third hour at the discretion of the instructor.*

Laboratory. *Six 2-hour sessions, to be arranged. 5 units.* Dr. Salhanick, Staff of the Department.

This course presents the fundamental physiology and biochemistry related to known and potential methods of family planning. Topics covered include the biosynthesis, secretion, effects, and modes of action of the gonadal and gonadotropic hormones; the relationship of the natural steroid hormones to synthetic analogues is also discussed. Laboratory sessions include demonstrations of a family planning clinic, an infertility unit, and procedures for sterilization and pregnancy termination.

Prerequisites: Population Sciences 200a,b and appropriate science background.

### **Population Sciences 205c,d. Readings in Population Studies**

Seminars. *One 1½-hour session each week. 2.5 units.* Staff of the Department.

This course is an introduction to the literature pertaining to population theory, research, and fertility control programs. It is offered for students concentrating in the Department. Seminar discussions are directed toward the analysis and evaluation of the assigned selections.

### **Population Sciences and Health Services Administration 207c,d. Design and Management of Population Programs**

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. D. Korten, Dr. F. Korten, Dr. Wyon, Staff of the Department.

This course addresses problems of translating population policies into action programs from three levels: (1) the national development planner who must integrate a population policy into a variety of program efforts; (2) the program manager who must determine effective program design and implementation strategies; (3) the community whose structures and aspirations must appropriately interface with program design. Topics are covered primarily through case studies from population programs in developing countries.

Enrollment is subject to the approval of the instructors. This course complements Population Sciences 202c,d. Students will derive the most benefit by taking the two courses concurrently.

### **Population Sciences 208a,b. Population and Disequilibrium in Developing Countries (Sociology 280)**

Seminars. *One 2-hour session each week. 5 units.* Dr. Keyfitz, Dr. Revelle.

Seminars deal with the interactions of population change, rural development, and urbanization in developing countries. Faculty and students



compare approaches as applied to models of population equilibrium at the levels of the family, village, and larger regions, and study the process of disequilibrium caused by migration, mortality, technology, and human aspirations. Students present team term papers and at least one seminar.

Enrollment is subject to approval of the instructor.

**Population Sciences 211e. Evaluation and Management of the Infertile Couple**

Lectures, field visits. *Daily lectures during the one-week reading period between fall and spring terms. 1 unit.* Dr. McIntosh, Staff.

Primarily intended for students who will be working in family planning programs, this course deals with the evaluation and management of the infertile couple and the desirability of providing infertility services in family planning programs. The organization and operation of an infertility unit and methods for describing the population evaluated are discussed. Films of specific diagnostic procedures and a visit to the Fertility and Endocrine Unit at the Boston Hospital for Women are included.

Prerequisites: Population Sciences 200a,b and medical science background. Enrollment is limited and is subject to the approval of the instructor.

**Population Sciences 212c,d. An Economic Approach to Population Policy**

Lectures. *One 2-hour session each week, with a third hour at the discretion of the instructor. 5 units.* Dr. Repetto.

This course presents the economics relevant to the formulation and evaluation of population policies in developing countries and surveys present knowledge concerning the possible effectiveness of a broad range of intervention strategies. It covers welfare economics of population policies; interactions between fertility and economic development; the impact on population growth of policies to affect incomes, education, survivorship, old-age security, and related variables, as well as conventional family planning programs.

Prerequisites: Population Sciences 200a,b and Interdepartmental 210a,b, or equivalent.

**Population Sciences 214c,d. Issues in Population Education (Education X-103)**

Lectures. *One 2½-hour session each week. 5 units.* Dr. Kline.

The course examines current issues in population education, mainly in Latin America, Africa, and Asia, and the literature pertinent to these. Both school and nonschool population education is dealt with. Issues include: definition of population education, objectives, ethical questions, differences in school and nonschool population education, content, cur-

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riculum and training, organization, research and evaluation, geographical and cultural differences, and legal aspects.

Enrollment is subject to the approval of the instructor.

### **Population Sciences 216a,b. Politics, Population, and Public Policies** (Government 211)

Lectures. *One 2-hour session each week. 5 units.* Dr. John Montgomery (Professor of Public Administration), Dr. Joel Migdal (Associate Professor of Government), Staff of the Center.

This course deals with the application of the policy sciences to specific population policies in selected national contexts: family allowances and incentive schemes, abortion and contraceptive services, income restructuring and fertility, pass laws and exit taxes for migration, employment generation in the countryside, and malaria eradication programs.

### **Population Sciences 225a,b,c,d. Advanced Seminar in Field Research Methods**

Seminars, laboratory, field exercises. *One 2-hour session each week; additional hours to be arranged. 10 units.* Dr. Morgan, Dr. Wyon, Staff of the Department.

A field problem for joint study by participants is selected, an interview schedule prepared, and a sample drawn. Each participant is expected to carry out a designated number of field interviews. During the third and fourth periods, data collected are coded and analyzed. Participants are introduced to the use of computer equipment. Techniques involved in each of these methodological steps are discussed and appropriate readings assigned. A final report is to be prepared.

Prerequisites: Biostatistics 101a,b, Epidemiology 201a, and consent of the instructors. Participants are expected to have taken or to take concurrently Biostatistics 213b. Enrollment is limited to 15 students.

### **Population Sciences 285c,d. Applied Mathematical Demography Seminar** (Sociology 285)

Seminar. *One 2-hour session each week. 5 units.* Dr. Keyfitz.

This course consists of research on the topics of Population Sciences 185a,b.

Enrollment is subject to approval of the instructor.

### **Population Sciences 300. Tutorial Programs**

*Time and credit to be arranged.*

Students at the master's level may make arrangements for tutorial work and special reading on topics related to population problems. There may be an opportunity to consider the design of studies, programs, or analysis of data.

**Population Sciences 330e. Field Visits**

*One-week period between fall and spring terms or one-week period between third and fourth quarters. 1 unit.*

Students concentrating in the Department of Population Sciences may participate in visits to organizations currently active in demographic studies, community education, and research and service in fertility control.

**Additional Field Study**

At the end of the academic year, a field visit may be arranged for students majoring in the Department of Population Sciences.

Participation is limited to 10 students.

**Population Sciences 350-357. Research**

*Time and credit to be arranged.*

Candidates for doctoral degrees may undertake research in the Department or may integrate research in population sciences with a doctoral program in another department or at the Center for Population Studies.

Members of the Department and of the Center for Population Studies are currently engaged in research in the following areas:

- 350 Topics in field studies and programs (*Dr. Wyon, Dr. Plank, Dr. Guerrero, Dr. Berggren*).
- 351 Topics in biomedicine and reproductive physiology (*Dr. Salhanick, Dr. McIntosh*).
- 352 Topics in demography (*Dr. Keyfitz*).
- 353 Topics in population ethics (*Dr. Dyck, Dr. Potter*).
- 354 Topics in population policy (*Dr. Revelle*).
- 355 Topics in population economics (*Dr. Repetto*).
- 356 Topics in population and resource interaction (Center for Population Studies) (*Dr. Revelle, Dr. Thomas, Dr. Rogers*).
- 357 Topics in complex systems (*Dr. Levins*).

## DEPARTMENT OF SANITARY ENGINEERING

Harold A. Thomas, Jr., S.B., S.M., S.D., Gordon McKay Professor of Civil and Sanitary Engineering

J. Carrell Morris, S.B., A.M., Ph.D., A.M. (hon.), Gordon McKay Professor of Sanitary Chemistry

Joseph J. Harrington, B.C.E., A.M., Ph.D., Professor of Environmental Health Engineering in the Faculty of Public Health and Gordon McKay Professor of Environmental Engineering in the Faculty of Arts and Sciences

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The courses in which members of this Department participate in the School of Public Health are listed on page 70 (Environmental Health Interdepartmental 201a, 201b) and on page 59 (Interdepartmental 215c,d).

The courses of instruction listed below are offered in the Division of Engineering and Applied Physics of the Graduate School of Arts and Sciences. Graduates of engineering colleges or scientific schools may be admitted to the Division as candidates for the degree of Master of Science or Doctor of Philosophy. They may elect appropriate courses in the School of Public Health as part of the program for these degrees. Further information can be obtained by writing to the Committee on Admissions, Graduate School of Arts and Sciences, Holyoke Center, 75 Mt. Auburn Street, Cambridge, Massachusetts 02138.

The following courses offered in the Division are open to properly qualified students from the School of Public Health:

### **Engineering Sciences 171. Chemistry of the Aqueous Environment**

Half course (*fall term*). *M., W., F., at 11.* Professor Butler.

Chemical principles applicable to environmental science and engineering. Physical chemistry of aqueous media with emphasis on pH, complex formation, and solubility in multicomponent systems. Principles of analytical chemistry and their application to analysis of water. Sources, occurrence, and chemical reactions of important constituents in natural waters.

Prerequisite: Chemistry 10 or equivalent.

### **Engineering Sciences 172. Laboratory Methods in Environmental Sciences**

Half course (*spring term*). *Hours to be arranged. Approximately 12 laboratory hours per week, including preparation and report writing.*

To be given in 1977-78.

Techniques for the determination of biological and chemical parameters of environmental significance, including: microbial populations, micro-

bial growth rates, nutrient concentrations, chemical pollutants. Includes both "wet" methods and modern instrumental analysis. Emphasis on experimental design, sampling techniques, and significance of results. At least one field project required.

Prerequisites: Chemistry 4, Biology 2, or equivalent laboratory experience. Permission of instructor required.

**Engineering Sciences 173. Introduction to Environmental Microbiology**

Half course (*spring term*). M., W., F., at 11, and laboratory hours to be arranged. Professor Mitchell.

Introduction to microbiology. Emphasis on microbial ecology. Application to problems in water pollution.

**Engineering 250a. Design of Water Resource Systems**

Half course (*fall term*). M., W., F., at 8. Professor Thomas.

Principles of engineering and economic analysis applied to water resource systems. Functional design of comprehensive management systems for collection, storage, conveyance, treatment, and distribution of water uses. Techniques of operations research and econometrics to develop methods for planning integrated systems of dams, reservoirs, canals, pipelines and networks, pumps, and treatment plants.

Prerequisites: Applied Mathematics 105a; Engineering Sciences 121, 123 or equivalents.

**Engineering 250b. Design of Water Resource Systems**

Half course (*spring term*). M., W., F., at 8. Professor Thomas.

Continuation of Engineering 250a, with emphasis on nonlinear systems and systems with stochastic components. Application to multiunit systems for industrial, municipal, and agricultural water supply, navigation, hydropower conservation of wildlife, and the preservation and enhancement of the environment.

Prerequisite: Engineering 250a. Statistics 190 or equivalent desirable.

**Engineering 251. Water Resources Design Practice**

Half course (*spring term*). M., 2-4. Professor Fiering.

To be given in 1977-78.

This course emphasizes engineering considerations required to design selected components of water-resource systems. Whereas other courses in this area stress planning and optimization procedures, this course focuses on translation from model studies to design specifications. Each student performs a complete design exercise, including assembly of data, interaction with agency officials, budgeting, and dimensioned sketches. Written and oral presentation required.



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### **Engineering 253. Stochastic Processes**

Half course (*fall term*). *M., W., F., at 9.* Professor Fiering.

Theory and applications of stochastic processes and time series for environmental problems, including hydrology, birth-death processes, hazard perception, storage systems, queues, Markov chains, multivariate techniques, and spectral analysis.

Prerequisites: Engineering 250a, Statistics 190, or equivalents.

### **Engineering 254. Mathematical Programming for Large Systems**

Half course (*spring term*). *M., W., F., at 11.* Professor Rogers.

To be given in 1977-78.

Application of optimizing theory to large environmental control systems. Practical problems involved in formulation and computation of mathematical programming models for these systems. Decomposition, multi-level and multi-objective planning, stochastic and mixed integer programming models.

Prerequisite: Economics 2140b or 2140c.

### **Engineering 257. Seminar: Models for Environmental Systems Planning**

Half course (*throughout the year*). *Hours to be arranged.* Professors Fiering, Harrington, Rogers, and Thomas.

Critical evaluation of current systems applications in environmental science, with emphasis on models for the analysis of standards, optimality, and resilience in water-resource systems. Papers and presentations are required.

### **Engineering 270. Engineering Systems for Environmental Control**

Half course (*spring term*). *M., W., F., at 10.* Professor Harrington.

To be given in 1977-78.

Provision of urban water; engineering aspects of the collection and disposal of spent water and solid wastes; significant interchanges between the gaseous, liquid, and solid phases of the environment; geographic interchanges; time-dependent developments. Data collection and processing for monitoring and control; maintenance and operation of pollution control systems.

Prerequisite: Engineering Sciences 123.

### **Engineering 272. Water Quality and Its Management**

Half course (*spring term*). *Tu., Th., 11-12:30.* Professor Morris.

Nature, sources, and effects of inorganic and organic impurities in natural waters. Water quality standards. Effects of contaminating and polluting

discharges on water quality. Natural purification of surface waters. Chemical and biochemical transformations in lakes and rivers.

Prerequisites: Engineering Sciences 171 and 173.

### **Engineering 273. Water Pollution Microbiology**

Half course (*fall term*). M., F., 2-3:30. Professor Mitchell.

Advanced discussion of the role of microorganisms as both pollutants and purifying agents. Particular attention to ecological approaches to pollution control. Eutrophication, microbial imbalances, pesticides, stream purification, and a critical discussion of current waste treatment methods.

Prerequisite: Engineering Sciences 173 or equivalent.

### **Engineering 274. Chemical Models of Natural and Polluted Waters**

Half course (*spring term*). Tu., 1-4. Professor Butler.

To be given in 1977-78.

Chemical aspects of aqueous environmental systems within the framework of mathematical modeling. Models include thermodynamic, kinetic, and hydrodynamic processes. Emphasis on developing realistic predictive models for actual cases encountered in water quality management, pollution control, limnology, oceanography, and geology.

Prerequisites: Physical chemistry (e.g., Engineering Sciences 171) and some experience in computer programming.

### **Engineering 276. Treatment of Water Supplies and Wastewaters**

Half course (*fall term*). M., W., F., at 10. Professor Morris.

To be given in 1977-78.

Quality standards for water supplies. Chemistry of processes for treating natural waters for municipal use, including coagulation, softening, deferrization, disinfection, adsorption, and demineralization. Characterization of wastewaters. Effluent and receiving-water standards. Physical, chemical, and biological treatment of wastewaters, including "advanced" methods.

Prerequisite: Engineering Sciences 171 or permission of instructor.

### **Engineering 277. Surface Phenomena**

Half course (*fall term*). M., W., F., at 10. Professor Morris.

Liquid surfaces and surface-active materials. The Gibbs equation. Two-dimensional equations of state. Adsorption at solid surfaces. The colloidal state. Electrokinetic phenomena. Structure, surface properties, and colloidal behavior of hydrous oxides and silicate minerals.

Prerequisite: Engineering Sciences 171 or equivalent background in physical chemistry.

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### Engineering 278. Rate Processes

Half course (*spring term*). *M., W., F., at 10.* Professor Morris.

To be given in 1977-78.

Chemical kinetics, with emphasis on reactions in aqueous systems and enzyme-mediated processes. Interpretation of kinetic data. Inorganic reaction mechanisms. Fast reactions. Reaction dynamics in water and waste treatment.

Prerequisite: Engineering Sciences 171 or equivalent.

### Engineering 279. Applied Electrochemistry

Half course (*spring term*). *Hours to be arranged.* Professor Butler.

Dynamic interpretation of electrochemical processes. Electrode kinetics, the electric double layer, and electrokinetic phenomena. A seminar for advanced students and researchers concerned with equilibrium structure and kinetic processes at charged interfaces, including electrodes, sediment particles, synthetic materials, and biological membranes.

Prerequisites: Chemistry 10, Physics 12a and b, and Applied Mathematics 21a and b or Mathematics 21a and b, or equivalents.

## DEPARTMENT OF TROPICAL PUBLIC HEALTH

Thomas H. Weller, A.B., S.M., M.D., LL.D., Richard Pearson Strong Professor of Tropical Public Health, Director of the Center for the Prevention of Infectious Diseases, and Head of the Department

*Faculty:* Professors Chernin and Morrow; Associate Professors W. Berggren, Michelson, Pan, and Spielman; Visiting Associate Professor Chinery; Assistant Professors Boyer, Coolidge, Hopkins, Mott, and Waner; Lecturer Daggy  
*Teaching and Research Staff:* Visiting Lecturers Fendall, Kaiser, Mata, Moschella, Most, Neva, Popenoe, Scrimshaw, and Sencer; Research Associate Hoff; Assistant Wheeldon

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The health problems of the tropical regions, as in all poorly sanitated areas, are predominantly of an infectious and nutritional nature. The infectious diseases are the primary concern of the Department of Tropical Public Health, with emphasis given to protozoal, helminthic, and viral entities and to relevant arthropod and molluscan intermediate hosts. Within the framework of the Center for the Prevention of Infectious Diseases, the Department of Tropical Public Health shares with the Department of Microbiology the responsibility for an integrated presentation of information on important infectious agents.

Therefore, the basic course, Tropical Public Health and Microbiology 201a,b, is designed to provide students in the Master of Public Health program with knowledge regarding major infectious diseases, and with factual information concerning the epidemiology and control of selected entities of public health importance.

The resolution of the health problems of tropical areas requires a multidisciplinary approach involving a considered appraisal of human resources as well as of relevant social, economic, and political factors. Thus, the student concentrating in the Department in preparation for a career in the field of international health should, in addition to departmental courses, acquire a broadened experience by elective work in other areas.

The investigative program in the Department currently deals with pathogens ranging from viruses to helminths. Studies on the *in vitro* cultivation and the physiology and immunology of a wide variety of agents are in progress. Biological investigations on the molluscan vectors of the schistosomes comprise another area of major interest. Facilities are available for the training of a limited number of students at the Doctor of Public Health or Doctor of Science level. The doctoral degree applicant should, if possible, obtain the necessary medical science background prior to enrollment. Collaborative arrangements established with institutions in the tropics provide diversified opportunities for study and research overseas.

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### **Tropical Public Health and Microbiology 201a,b. Ecology and Epidemiology of Infectious Diseases**

Lectures, seminars, demonstrations; laboratory elective. *Four 1-hour sessions and one 2-hour elective laboratory session each week, first period; one 1-hour session and two 2-hour sessions each week, second period. 5 units; 6 units if laboratory elected.* Dr. Weller, Dr. Nichols, Staffs of the Departments.

The communicable diseases of major public health importance are considered on an integrated basis. Discussions encompass the status of infectious diseases in developing and developed countries, and the rationale of selecting procedures for disease control. A knowledge of the pathogenesis of disease produced by infectious agents is desirable.

### **Microbiology and Tropical Public Health 202b. Critiques of Current Literature on Infectious Diseases**

Seminars. *One 2-hour session each week. 1 unit.* Dr. Chernin, Dr. Buckley, Staffs of the Departments.

(Course is described under Department of Microbiology.)

### **Tropical Public Health 203d. Perspectives in Tropical Health**

Lectures, conferences. *One 2-hour session each week. 1 unit.* Dr. Weller, Guest Lecturers.

This course provides background information on environmental, social, economic, and political factors that influence health programs in the tropics. At each session a distinguished guest lecturer covers an assigned topic, including such subjects as the development of professional education, problems of agriculture, nutrition, and water supply, and the political background of international cooperation. Each presentation is followed by informal student discussion. Enrollment is open to all students.

### **Tropical Public Health 204c. Laboratory Aspects of Parasitic Diseases**

Lectures, seminars, laboratory exercises. *Two 3-hour sessions each week. 2.5 units.* Dr. Pan, Dr. Coolidge.

This course emphasizes laboratory methods for the study of parasitic diseases of public health importance. Students are exposed to the theory and application of techniques essential to epidemiologic and laboratory investigation. The life cycles of several parasites are maintained and examined with respect to detection and quantification of infection, immunity, and control.

Enrollment is limited and is subject to the approval of the instructor.



**Tropical Public Health 205c. Clinical and Pathologic Features of Tropical Diseases**

Case presentations, clinico-pathologic conferences, demonstrations. *One 2-hour session each week. 1 unit.* Dr. Weller, Dr. Hopkins, Dr. Coolidge, Dr. Boyer, Dr. Franz von Lichtenberg (Professor of Pathology, Harvard Medical School), Staff of the Department.

This course, designed for students particularly interested in tropical medicine, supplements material presented in Tropical Public Health and Microbiology 201a,b. The emphasis is on the clinico-pathologic aspects of tropical diseases. At each session disease entities are introduced by presenting a clinical case, and pertinent clinical and pathologic features of the disease are then reviewed.

Enrollment is subject to the approval of the instructor.

**Tropical Public Health 207d. Introduction to Molluscs of Public Health Importance**

Conferences, laboratory and field exercises. *One 3-hour session each week. 2 units.* Dr. Michelson.

To be given in 1976-77; alternates yearly with Tropical Public Health 208d.

This is an introductory course designed to acquaint the student with the molluscs which may act either as active or passive agents for the dispersal of pathogens, toxins, or parasites which cause disease in man. Special emphasis is given to snails which serve as intermediate hosts of mammalian schistosomes. Students are offered the opportunity to study field and laboratory techniques necessary for an understanding of the taxonomy, morphology, cultivation, ecology, and control of these medically important molluscs.

Enrollment is subject to the approval of the instructor.

**Tropical Public Health 208d. Epidemiology and Control of Schistosomiasis**

Seminars, laboratory exercises. *One 3-hour session each week. 2 units.* Dr. Michelson, Dr. Chernin, Dr. Pan, Dr. Weller.

To be given in 1977-78; alternates yearly with Tropical Public Health 207d.

The problems posed by schistosomiasis as an expanding health hazard are presented in a series of seminars and laboratory exercises. Emphasis is given to the biology of snail vectors, to problems of assessment of significance of the disease, and to the potentials of various approaches to control. Opportunity to become familiar with appropriate techniques is afforded in the laboratory.

Enrollment is subject to the approval of the instructor.

## SCHOOL OF PUBLIC HEALTH

### **Tropical Public Health 209d. Introduction to Medical Entomology**

Conferences, laboratory, field exercises. *One 3-hour session each week. 2 units.* Dr. Spielman.

To be given in 1977-78; alternates yearly with Tropical Public Health 210d. This course deals with the insects, ticks, and mites of public health importance. The manner in which arthropods transmit disease and the principles of vector control are discussed from ecological, physiological, and genetic points of view. Colonies of various vector species are maintained by the students to provide the basic material for study of life cycles and for arthropod identification. Laboratory and field exercises demonstrate entomological techniques currently employed by epidemiologists.

Enrollment is subject to the approval of the instructor.

### **Tropical Public Health 210d. Current Problems in Malariology**

Seminars, laboratory exercises. *One 3-hour session each week. 2 units.* Dr. Chernin, Dr. Spielman, Dr. Weller, Staff of the Department.

To be given in 1976-77; alternates yearly with Tropical Public Health 209d. This course supplements the subject material on malaria offered in Tropical Public Health and Microbiology 201a,b and Tropical Public Health 204c. Particular attention is given to problems now encountered in eradication and control programs. In the laboratory, experience is provided with procedures essential to the epidemiologic investigation of malaria.

Enrollment is subject to the approval of the instructor.

### **Tropical Public Health and Microbiology 214c,d. Case Studies in Epidemiology of Infectious Disease**

Seminars, laboratory exercises. *One 2-hour session each week. 2.5 units.* Dr. Hopkins, Dr. Langmuir (Visiting Professor of Epidemiology, Harvard Medical School), Dr. Nichols.

This course deals with problems in the epidemiology of communicable and other acute diseases. In each session a case study is taken from an actual epidemic or other acute disease control situation, and the student is asked to assume the role of investigator and control officer.

### **Microbiology and Tropical Public Health 217d. Virology**

Lectures, seminars. *Three 1-hour sessions each week. 2.5 units.* Dr. Essex, Dr. Waner.

(Course is described under Department of Microbiology.)

### **Tropical Public Health 300a,b,c,d,e. Tutorial Programs**

Laboratory exercises. *Time and credit to be arranged.*

Individual work for candidates at the master's degree level may be carried out under supervision of a member of the Department. Various parasites

of medical importance are maintained and are available for studies on metabolism, host-parasite relationships, and chemotherapy. Arrangements are subject to the approval of the instructor.

### **Tropical Public Health 350. Research**

Doctoral candidates or qualified full-time special students may undertake original investigations in the laboratory or in the field by arrangement with the Head of the Department.

Members of the Department are currently engaged in the following areas of research:

- 351 Tissue culture and immunological techniques as applied to problems in medical virology (*Dr. Weller, Dr. Waner*).
- 352 Cultivation *in vitro* of parasitic helminths, protozoa, and other invertebrates of medical importance (*Dr. Weller, Dr. Chernin, Dr. Pan*).
- 353 Biology, host-parasite relationships, and control of molluscan vectors of schistosomiasis and of other parasitic infections (*Dr. Chernin, Dr. Michelson, Dr. Pan*).
- 354 Population genetics, nutrition, and reproduction of medically important arthropods (*Dr. Spielman*).
- 355 Arthropod transmission of viral, protozoan, and helminthic agents (*Dr. Spielman*).
- 356 Immunology of yaws and syphilis (*Dr. Hopkins*).
- 357 Immunology of schistosomiasis (*Dr. Boyer, Dr. Weller*).
- 358 Epidemiology of Chagas' disease and schistosomiasis in rural Brazil (*Dr. Mott*).
- 359 Mechanisms of health care in rural Haiti (*Dr. Berggren*).

# Officers of Instruction and Research

## MEMBERS OF THE FACULTY

- William Alonso, Ph.D., Richard Saltonstall Professor of Population Policy; *Director of the Center for Population Studies.*
- Mary Ochsenhirt Amdur, Ph.D., Associate Professor of Toxicology (*Physiology*).
- Harry Nicholas Antoniadis, Ph.D., Associate Professor of Biochemistry (*Nutrition*); *Senior Investigator, Blood Research Institute, Inc., Boston.*
- James Edward Austin, D.B.A., Lecturer on Nutrition Planning and Policy (*Nutrition*); *Associate Professor of Business Administration, Harvard Business School.*
- Robert Charles Benfari, M.B.A., Ph.D., S.M. in Hyg., Associate Professor of Psychology (*Behavioral Sciences*).
- Gretchen Mary Berggren, M.D., S.M. in Hyg., Assistant Professor of Population Sciences (absent 76-77).
- Warren Lee Berggren, M.D., Dr.P.H., Associate Professor of Tropical Public Health and Population Sciences (absent 76-77).
- Ralph Edward Berry, Jr., Ph.D., Professor of Economics (*Health Services*).
- Yvonne Millicent Mahala Bishop, Ph.D., Associate Professor of Biostatistics.
- Bengt Erik Bjarngard, D.Sc., Lecturer on Medical Radiation Physics (*Environmental Health Sciences*); *Associate Professor of Radiation Therapy, Harvard Medical School.*
- Markley Holmes Boyer, M.D., D.Phil., M.P.H., Assistant Professor of Tropical Public Health.
- Joseph David Brain, S.D. in Hyg., Associate Professor of Physiology; Acting Associate Dean for Academic Affairs.
- Peter Braun, M.D., Lecturer on Public Health (*Health Services*).
- Helen Regina Buckley, Ph.D., Assistant Professor of Medical Mycology (*Microbiology*).
- William Alfred Burgess, S.M., Associate Professor of Occupational Health Engineering (*Environmental Health Sciences*).
- Jay Cerny, M.D., Ph.D., Associate Professor of Immunology (*Microbiology*).
- Gordon Chase, A.B., Lecturer on Health Policy (*Interdepartmental*); Director of Executive Programs in Health Policy and Management.
- Eli Chernin, S.D., Professor of Tropical Public Health.
- W. A. Chinery, Ph.D., Visiting Associate Professor of Tropical Public Health; *Professor of Microbiology, University of Ghana Medical School.*
- Niels Edward Christiansen, Ph.D., Assistant Professor of Sociology (*Nutrition*).
- Philip Timothy Cole, M.D., Dr.P.H., Associate Professor of Epidemiology.
- Catherine Coolidge, M.D., M.P.H., Assistant Professor of Tropical Public Health.
- Douglas Winslow Cooper, Ph.D., Assistant Professor of Environmental Physics (*Environmental Health Sciences*).
- Allan Latham Cudworth, S.M. in E.E., S.D. in Hyg., Lecturer on Applied Acoustics and Environmental Health (*Environmental Health Sciences*); *Vice President of Liberty Mutual Insurance Company and Director, Hopkinton Research Center.*

- William John Curran, J.D., S.M. in Hyg., Frances Glessner Lee Professor of Legal Medicine in the Faculty of Medicine and the Faculty of Public Health (*Health Services*).
- Richard Henry Daggy, Ph.D., Dr.P.H., Lecturer on Tropical Public Health.
- Stanley Verne Dawson, S.D. in Hyg., Assistant Professor of Environmental Health Engineering (*Physiology*).
- Richard Dennis, S.M., Associate Professor of Applied Environmental Health Engineering (*Environmental Health Sciences*); *Director, Pollution Control Laboratory, G.C.A. Corporation, Bedford.*
- Paul Maxmillian Densen, S.D., Professor of Community Health (*Health Services*); *Director of the Center for Community Health and Medical Care, Harvard Medical School.*
- Richard William Dodds, M.D., Assistant Professor of Public Health (*Epidemiology*); *Pediatrician, Harvard Community Health Plan.*
- Margaret Elizabeth Drolette, M.P.H., Ph.D., Associate Professor of Biostatistics.
- Johanna Todd Dwyer, S.D. in Hyg., Lecturer on Maternal and Child Health Nutrition (*Health Services*); *Director, Stern Nutrition Center, Tufts Medical Center.*
- Arthur James Dyck, Ph.D., Mary B. Saltonstall Professor of Population Ethics; *Member of the Faculty of the Harvard Divinity School (on leave Sept. 1976-Feb. 1977).*
- Myron Elmer Essex, D.V.M., Ph.D., Associate Professor of Virology (*Microbiology*); *Scholar of the Leukemia Society of America, Inc.*
- Douglas Ewbank, Ph.D., Assistant Professor of Population Sciences.
- James Joseph Feeney, M.D., Member of the Faculty of Public Health; *Director of the Medical Area Health Service.*
- Jacob Joseph Feldman, Ph.D., Professor of Biostatistics.
- Penny Hollander Feldman, Ph.D., Assistant Professor of Political Science (*Health Services*).
- Benjamin Greeley Ferris, Jr., M.D., Professor of Environmental Health and Safety (*Physiology*); *Director of Environmental Health and Safety, University Health Services.*
- Lawrence Jay Fine, M.D., Dr.P.H., Assistant Professor of Occupational Medicine (*Physiology*).
- Harvey Vernon Fineberg, M.D., M.P.P., Assistant Professor of Health Services Administration.
- Melvin William First, S.D., Professor of Environmental Health Engineering (*Environmental Health Sciences*).
- Maurice Sanford Fox, Ph.D., Visiting Professor of Biology (*Interdepartmental*); *Professor of Biology, Massachusetts Institute of Technology.*
- Charles Edward Ovid Fraser, D.T.V.M., Ph.D., Assistant Professor of Microbiology; *Microbiologist, New England Regional Primate Research Center.*
- Howard Stanley Frazier, M.D., Director of the Center for Analysis of Health Practices and Member of the Faculty of Public Health; *Associate Professor of Medicine, Harvard Medical School.*
- Todd Mearl Frazier, S.M., Associate Professor of Biostatistics; *Assistant Direc-*



## SCHOOL OF PUBLIC HEALTH

*tor, Center for Community Health and Medical Care, Harvard Medical School.*

Rose Epstein Frisch, Ph.D., Lecturer on Population Studies (*Population Sciences*).

Stanley Norton Gershoff, Ph.D., Associate Professor of Nutrition.

Robert Pershing Geyer, Ph.D., Professor of Nutrition.

Michael David Goldman, M.D., S.D. in Phys., Assistant Professor of Physiology.

Robert Johns Haggerty, M.D., Roger Irving Lee Professor of Public Health (Health Services and Pediatrics) in the Faculty of Public Health and the Faculty of Medicine.

Joseph John Harrington, Ph.D., Professor of Environmental Health Engineering (*Sanitary Engineering*) in the Faculty of Public Health and Gordon McKay Professor of Environmental Engineering in the Faculty of Arts and Sciences.

Kenneth Cronise Hayes, D.V.M., Ph.D., Associate Professor of Nutrition.

David Mark Hegsted, Ph.D., Professor of Nutrition.

Manuel Guillermo Herrera-Acena, M.D., Associate Professor of Medicine (*Nutrition*).

John Edwin Herrmann, Ph.D., Assistant Professor of Microbiology.

Howard Haym Hiatt, M.D., Dean of the Faculty of Public Health; *Professor of Medicine, Harvard Medical School.*

William Carson Hinds, S.D. in Env. H., Assistant Professor of Environmental Health Engineering (*Environmental Health Sciences*).

Donald Roswell Hopkins, M.D., M.P.H., Assistant Professor of Tropical Public Health.

Frederic Gallatin Hoppin, Jr., M.D., Associate Professor of Physiology.

William Ching-Lung Hsiao, M.P.A., Associate Professor of Economics (*Health Services*); *Member of the Faculty of Harvard Business School.*

Agnes Mayer Huber, Ph.D., Assistant Professor of Nutrition.

George Barkley Hutchison, M.D., M.P.H., Professor of Epidemiology.

Rudolph John Jaeger, Ph.D., Assistant Professor of Toxicology (*Physiology*).

Ellen Whiteman Jones, M.P.H., Lecturer on Biostatistics; *Assistant Director, Center for Community Health and Medical Care, Harvard Medical School.*

Stephen Carl Joseph, M.D., M.P.H., Lecturer on International Child Health (*Health Services*); *Director of the Office of International Health Programs.*

Jack Kasten, M.P.H., J.D., Lecturer on Health Services Administration; *Consultant, Arthur D. Little, Inc., Cambridge.*

Ann Randtke Kennedy, S.D. in Phys., Assistant Professor of Radiobiology (*Physiology*).

George Roderick Kerr, M.D., C.M., Associate Professor of Nutrition.

Nathan Keyfitz, Ph.D., Andelot Professor of Sociology in the Faculty of Arts and Sciences and of Demography in the Faculty of Public Health (*Population Sciences*).

Richard Clark Killin, LL.B., Member of the Faculty of Public Health; Associate Dean for Administration.

Joel Charles Kleinman, Ph.D., Assistant Professor of Biostatistics (on leave 76-77).

David Craig Korten, M.B.A., Ph.D., Lecturer on Population Studies (*Population*

- Sciences); *Institute Associate, Harvard Institute for International Development.*
- Nan Laird, Ph.D., Assistant Professor of Biostatistics.
- Dwight Wilson Lambe, Jr., Ph.D., Lecturer on Microbiology; *Scientific Associate in Pathology and Microbiology, Deaconess Hospital.*
- David Evan Leith, M.D., Associate Professor of Physiology.
- David Hugh Leith, S.M. in C.E., S.D. in Env. H., Assistant Professor of Environmental Health Engineering (*Environmental Health Sciences*).
- Richard Levins, Ph.D., John Rock Professor of Population Sciences.
- John Bertram Little, M.D., Professor of Radiobiology (*Physiology*).
- Bernard Lown, M.D., Professor of Cardiology in Nutrition.
- Mohamed Sayed el Lozy, M.B., B.Ch., Assistant Professor of Nutrition.
- Alex Bruce MacDonald, Ph.D., Associate Professor of Immunology (*Microbiology*).
- Brian MacMahon, M.D., D.P.H., Ph.D., S.M. in Hyg., Professor of Epidemiology.
- Morton Abraham Madoff, M.D., M.P.H., Lecturer on Applied Microbiology; *Superintendent, State Laboratory Institute, Massachusetts Department of Public Health.*
- George Stephen Masnick, Ph.D., Associate Professor of Demography (*Population Sciences*).
- William Edward McAuliffe, Ph.D., Associate Professor of Sociology (*Behavioral Sciences*).
- Robert Burnett McGandy, M.D., M.P.H., Associate Professor of Environmental Medicine (*Physiology*).
- Edward Noel McIntosh, M.D., S.D. in Popl., Assistant Professor of Population Sciences; *Assistant Professor of Obstetrics and Gynecology, Harvard Medical School* (absent 76-77).
- Jere Mead, M.D., Cecil K. and Philip Drinker Professor of Environmental Physiology (*Physiology*).
- Charles Marie Joseph Mertens de Wilmers, M.D., Lic. en Psych., Visiting Professor of Psychiatry (*Behavioral Sciences*); *Professor of Medical Psychology, Faculty of Medicine, Catholic University of Louvain, Belgium.*
- Edward Harlan Michelson, Ph.D., Associate Professor of Tropical Public Health.
- Olli Sakari Miettinen, M.D., M.P.H., Ph.D., Professor of Epidemiology and Biostatistics.
- Farrokh Ziaollah Modabber, Ph.D., Assistant Professor of Immunology (*Microbiology*); *Associate Professor of Immunobiology, University of Teheran School of Public Health* (absent 76-77).
- Dade William Moeller, Ph.D., Professor of Engineering in Environmental Health; Associate Director, Kresge Center for Environmental Health.
- Richard Redding Monson, M.D., S.D. in Hyg., Associate Professor of Epidemiology.
- Jose Obdulio Mora, M.D., S.M. in Nutr., Assistant Professor of Nutrition; *Head, Epidemiology Section, Direccion de Nutricion, Instituto Colombiano de Bienestar Familiar, Bogota, Colombia.*
- John Carrell Morris, Ph.D., Gordon McKay Professor of Sanitary Chemistry (*Sanitary Engineering*).

## SCHOOL OF PUBLIC HEALTH

- Alan Sydney Morrison, M.D., S.D. in Epid., Assistant Professor of Epidemiology.
- Richard Harold Morrow, M.D., M.P.H., Professor of Tropical Public Health (on leave 76-77).
- Kenneth Eugene Mott, M.D., M.P.H., Assistant Professor of Tropical Public Health (absent 76-77).
- Jane M. Murphy, Ph.D., Associate Professor of Anthropology (*Behavioral Sciences*).
- Raymond Leo Harrington Murphy, Jr., M.D., M.P.H., S.D. in Hyg., Lecturer on Occupational Medicine (*Physiology*); *Director, Pulmonary Service, Faulkner Hospital*.
- Sheldon Douglas Murphy, Ph.D., Associate Professor of Toxicology (*Physiology*).
- Edward Stevenson Murray, M.D., M.P.H., Professor of Microbiology.
- H. Richard Nesson, M.D., Associate Professor of Health Services; Director, Office of Extramural Health Programs; *Associate Professor of Medicine, Harvard Medical School; Director of Ambulatory Services, Peter Bent Brigham Hospital*.
- Duncan Neuhauser, M.H.A., Ph.D., Associate Professor of Health Services Administration.
- Raymond Richard Neutra, M.D., C.M., Dr.P.H., Assistant Professor of Epidemiology; *Assistant Professor of Preventive and Social Medicine, Harvard Medical School*.
- Roger Loyd Nichols, M.D., Irene Heinz Given Professor of Microbiology; Associate Director, Center for the Prevention of Infectious Diseases.
- Steve Chia-Tung Pan, M.D., M.P.H., Associate Professor of Tropical Public Health.
- John Milton Peters, M.D., M.P.H., S.D. in Hyg., Professor of Occupational Medicine (*Physiology*).
- Daniel Pometta, M.D., Visiting Associate Professor of Medicine (*Epidemiology*); *Chief of Diabetes Service, Department of Medicine, University of Geneva*.
- Robert Balentine Reed, Ph.D., Professor of Biostatistics.
- Robert Copeland Repetto, Ph.D., Associate Professor of Economics and Population (*Population Sciences*).
- Roger Revelle, Ph.D., Professor of Population Policy.
- Julius Benjamin Richmond, M.D., Professor of Preventive and Social Medicine in the Faculty of Medicine and the Faculty of Public Health; *Professor of Child Psychology and Human Development, Harvard Medical School*.
- Marc Jeffrey Roberts, Ph.D., Professor of Political Economy and Health Policy (*Health Services and Physiology*); Academic Director of Executive Programs in Health Policy and Management.
- Barbara Gutmann Rosenkrantz, Ph.D., Professor of the History of Science in the Faculty of Arts and Sciences and the Faculty of Public Health.
- Kenneth Jay Rothman, D.M.D., Dr.P.H., Associate Professor of Epidemiology (absent 76-77).
- Harbans Sachdev, Ph.D., Assistant Professor of Organic Chemistry (*Nutrition*).
- Hilton Aaron Salhanick, Ph.D., M.D., Frederick Lee Hisaw Professor of Repro-

## FACULTY

- ductive Physiology (*Population Sciences*); *Professor of Obstetrics and Gynecology, Harvard Medical School.*
- Kenneth Wayne Samonds, Ph.D., Assistant Professor of Nutrition.
- Ascher Jasha Segall, M.D., Dr.P.H., Associate Professor of Epidemiology.
- Alan Sheldon, M.B.,B.Chir.,D.P.M., S.M. in Hyg., Associate Professor of Behavioral Sciences.
- Jacob Shapiro, Ph.D., Lecturer on Biophysics in Environmental Health (*Environmental Health Sciences*).
- Herbert Sherman, D.E.E., Lecturer on Health Services Administration; Director of the Office of Program Planning.
- Jeannette Jane Simmons, M.P.H., S.D. in Hyg., Member of the Faculty of Public Health; Assistant Dean of Students.
- Stover Hoffman Snook, Ph.D., Lecturer on Ergonomics (*Physiology*); *Project Director, Liberty Mutual Insurance Company.*
- Sergei Pitirimovitch Sorokin, M.D., Assistant Professor of Cell Biology (*Physiology*).
- Roger Benham Spaulding, A.B., Member of the Faculty of Public Health; Assistant Dean and Director of the Development Office.
- George Edward Spencer, M.D., Lecturer on Occupational Medicine (*Physiology*); *Medical Director, New England Telephone Company.*
- John Daniel Spengler, Ph.D., S.M. in Env. H., Assistant Professor of Environmental Health.
- Andrew Spielman, S.D., Associate Professor of Tropical Public Health.
- Fredrick John Stare, Ph.D., M.D., Professor of Nutrition.
- William Boaz Stason, M.D., M.P.H., Assistant Professor of Health Services Administration.
- Robert Michael Strong, Ph.D., Lecturer on Medical Technology and Data Systems (*Health Services*).
- Shirley Warnock Thenen, Ph.D., Assistant Professor of Nutrition.
- Eoin William Trevelyan, D.B.A., Lecturer on Management (*Health Services*).
- Harold Allen Thomas, Jr., S.D., Gordon McKay Professor of Civil and Sanitary Engineering.
- Mark Smith Thompson, Ph.D., Assistant Professor of Health Services Administration; Associate in the Center for the Analysis of Health Practices.
- Dwight Wingate Underhill, S.D. in Hyg., Assistant Professor of Environmental Health Engineering (*Physiology*).
- Isabelle Valadian, M.D., M.P.H., Associate Professor of Maternal and Child Health (*Health Services*).
- Richard Leonard Verrier, Ph.D., Assistant Professor of Physiology (*Nutrition*).
- John William Vinson, S.D. in Hyg., Associate Professor of Microbiology.
- Panagiotis Constantine Voukydis, M.D., D.M.Sc., Ph.D., Assistant Professor of Cardiology (*Nutrition*).
- Warren Ernest Clyde Wacker, M.D., Henry K. Oliver Professor of Hygiene; *Director of University Health Services.*
- Joseph Lloyd Waner, Ph.D., Assistant Professor of Tropical Public Health.
- James Heber Warram, Jr., M.D., S.M. in Hyg., Assistant Professor of Biostatistics.
- Edward William Webster, Ph.D., Lecturer on Medical Radiation Physics (*En-*

## SCHOOL OF PUBLIC HEALTH

- vironmental Health Sciences*); Associate Professor of Radiology, *Harvard Medical School*.
- Henry Wechsler, Ph.D., Lecturer on Social Psychology (*Behavioral Sciences*); *Research Director, The Medical Foundation, Inc.*
- David Howe Wegman, M.D., S.M. in Phys., Assistant Professor of Occupational Health (*Physiology*).
- Thomas Huckle Weller, M.D., Richard Pearson Strong Professor of Tropical Public Health; Director of the Center for Prevention of Infectious Diseases.
- Nelson Priddy Westmoreland, D.V.M., Ph.D., Assistant Professor of Nutrition.
- James Laverre Whittenberger, M.D., James Stevens Simmons Professor of Public Health; Professor of Physiology; Director of the Kresge Center for Environmental Health; Associate Dean.
- Jerry Randall Williams, S.D. in Phys., Assistant Professor of Radiobiology (*Physiology*).
- Florence Arlene Wilson, M.D., Assistant Professor of Health Services Administration.
- Jelia Cox Witschi, S.M., Assistant Professor of Nutrition.
- Jane Worcester, Dr.P.H., Professor of Biostatistics and Epidemiology.
- Joe David Wray, M.D., M.P.H., Visiting Professor of International Health and Maternal and Child Health (*Health Services and Population Sciences*).
- John Benjamin Wyon, M.B.,B.Ch., M.P.H., Senior Lecturer on Population Studies.
- Joseph Anthony Yacavone, D.M.D., M.P.H., Lecturer on Dental Public Health (*Health Services*); *Assistant Clinical Professor of Dental Ecology, Harvard School of Dental Medicine*; *Chief, Office of Comprehensive Planning, Rhode Island Department of Health*.
- Alonzo Smythe Yerby, M.D., M.P.H., Professor of Health Services Administration.
- Marjorie Anne Christina Young, Dr.P.H., Professor of Health Education (*Health Services*).

## THE TEACHING STAFF

- Walter Pierce Allen, M.B.A., Visiting Lecturer on Health Services.
- Joel Jacobs Alpert, M.D., Visiting Lecturer on Health Services.
- David Martin Anderson, Ph.D., Visiting Lecturer on Industrial Hygiene Engineering (*Environmental Health Sciences*).
- Priscilla Mae Andrews, S.M., Visiting Lecturer on Health Services Administration.
- Elliott Leo Atamian, D.B.A., Lecturer on Health Services Administration.
- James Murdoch Austin, S.D., Visiting Lecturer on Meteorology and Air Pollution (*Environmental Health Sciences*).
- Kay Walker Bander, S.M. in H.S.Ad., Visiting Lecturer on Health Services Administration.
- Diana Barrett, S.M., M.B.A., Instructor in Management (*Health Services*).
- James Elmer Barrett, Jr., M.D., Visiting Lecturer on Social Psychiatry (*Behavioral Sciences*).



## TEACHING STAFF

- Mary Jane Ferraro Benfari, Ph.D., M.P.H., Instructor in Microbiology.
- Arthur Angelo Berarducci, M.P.H., Lecturer on Health Services Administration.
- Donald Mark Berwick, M.D., M.P.P., Instructor in Health Services.
- Charles Edgar Billings, Ph.D., Visiting Lecturer on Environmental Health Engineering (*Environmental Health Sciences*).
- James Patrick Boland, A.M., Visiting Lecturer on Health Economics (*Health Services*).
- Richard James Cannon, M.B.A., Visiting Lecturer on Health Services.
- Helen Dorothy Cohn, M.P.H., Lecturer on Public Health Nursing (*Health Services*).
- Jeanne Ann Coombs, Dr.P.H., Lecturer on Health Education (*Health Services*).
- Raymond Douglas Cotton, J.D., S.M. in Hyg., Visiting Lecturer on Health Law (*Health Services*).
- Thomas Richard Crowdis, Jr., S.M., Visiting Lecturer on Health Services.
- John Kenneth Dane, LL.B., LL.M., Visiting Lecturer on Workmen's Compensation (*Environmental Health Sciences*).
- Edward Milton Dolinsky, M.P.H., Visiting Lecturer on Health Services.
- Samuel Weith Dooley, M.D., Visiting Lecturer on Maternal and Child Health (*Health Services*).
- Harold Bruce Dull, M.D., S.M. in H.S.Ad., Visiting Lecturer on Health Law (*Health Services*).
- Karin Arntz Dumbaugh, A.M., S.M. in H.S.Ad., Instructor in Health Services.
- Felton James Earls, M.D., Visiting Lecturer on Health Services.
- Paul Sidney Entmacher, M.D., Visiting Lecturer on Health Services.
- Ronald Benjamin Levin-Epstein, A.B., Visiting Lecturer on Health Services.
- Neville Rex Edwards Fendall, M.D., D.P.H., Visiting Lecturer on Tropical Public Health.
- Mark George Field, Ph.D., Visiting Lecturer on Health Services Administration.
- Nicholas John Fiumara, M.D., M.P.H., Visiting Lecturer on Infectious Diseases (*Microbiology*).
- Peter David Fox, Ph.D., Visiting Lecturer on Health Services.
- Michael George Gero, M.B.A., Visiting Lecturer on Biostatistics.
- Robert Frederick Gilfillan, Ph.D., Visiting Lecturer on Applied Microbiology.
- George Francis Grady, M.D., Visiting Lecturer on Applied Microbiology.
- Rodrigo Guerrero, M.D., S.M. in Hyg., Dr.P.H., Visiting Lecturer on Population Sciences.
- Noel Guillozet, M.D., Lecturer on Child Health (*Health Services*).
- Jeannette Valiere Haase, Ph.D., Visiting Lecturer on Health Services.
- William Ephraim Hassan, Jr., Ph.D., LL.B., Visiting Lecturer on Hospital Administration (*Health Services*).
- David Hemenway, Ph.D., Lecturer on Health Services Administration.
- James Theodore Hilliard, J.D., Visiting Lecturer on Health Services.
- Christine Lee Hobart, D.B.A., Visiting Lecturer on Labor Relations (*Health Services*).
- Gertrude Texeira Hunter, M.D., Visiting Lecturer on Health Services Administration.
- Eleanore May Irish, M.P.H., Visiting Lecturer on Health Services.
- Hershel Jick, M.D., Lecturer on Epidemiology.

## SCHOOL OF PUBLIC HEALTH

- Robert Lincoln Kaiser, M.D., D.T.M.&H., Visiting Lecturer on Tropical Public Health.
- Edward Leonard Kelly, M.A., Visiting Lecturer on Health Services.
- Ralph Leo Kent, S.D. in Bio., Visiting Lecturer on Biostatistics.
- David Kent Kline, Ph.D., Lecturer on Population Education (*Population Sciences*).
- Anthony Leader Komaroff, M.D., Visiting Lecturer on Health Services.
- Frances Fisher Korten, Ph.D., Lecturer on Population Studies.
- Melvin Joel Krant, M.D., M.I.H., Visiting Lecturer on Behavioral Sciences.
- John Arthur LaCasse, S.M., Visiting Lecturer on Health Services.
- Arthur Jacques Lesser, M.D., M.P.H., Visiting Lecturer on Maternal and Child Health (*Health Services*).
- Sol Levine, Ph.D., Visiting Lecturer on Behavioral Sciences (*Health Services*).
- F. James Levinson, Ph.D., Visiting Lecturer on Nutritional Economics (*Nutrition*).
- Frederick Pei Li, M.D., Lecturer on Epidemiology.
- James Stratton Liljestrand, M.D., M.P.H., Visiting Lecturer on Health Services.
- Joanna Lion, Ph.D., Visiting Lecturer on Health Services Administration.
- Stephen Lorch, S.B., Lecturer on Health Services Administration.
- James Richard Mahoney, Ph.D., Visiting Lecturer on Applied Meteorology (*Environmental Health Sciences*).
- Aune Helen Martikainen, M.P.H., S.D. in Hyg., Visiting Lecturer on Health Education (*Health Services*).
- Leonardo Jimenez Mata, S.D. in Hyg., Visiting Lecturer on Tropical Public Health.
- Antonio Samuel Medina, M.D., M.P.H., Visiting Lecturer on Maternal and Child Health (*Health Services*).
- Katherine Powell Messenger, M.C.P., Lecturer on Child Health (*Health Services*).
- Robert Warwick Miller, M.D., Dr.P.H., Visiting Lecturer on Epidemiology.
- Gordon Tavss Moore, M.D., M.P.H., Lecturer on Health Services Administration.
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